AC Power
For *Business-Critical Continuity™*

Liebert® PPC™

Second Generation Power Conditioning and Distribution Cabinet

User Manual - 3 Phase, 15 - 225 kVA, 50 & 60 Hz

EMERSON
Network Power

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IMPORTANT SAFETY INSTRUCTIONS

NOTE
Read this entire manual before installing or operating the system.

WARNING

Risk of cutting bands under tension. Can cause injury or death.

The shipping bands may be under tension. Use appropriate eye, face and hand protection to safeguard against injury from band backlash.

WARNING

Risk of electric shock. Can cause injury or death.

Verify that all incoming line voltage (power) and low-voltage (control) circuits are de-energized and locked out before installing cables or making connections, whether in the junction box or in the unit.

Equipment inspection and startup should be performed only by trained personnel. Lethal voltages are present during startup procedures. Electrical safety precautions must be followed throughout inspection and startup.

Only properly trained and qualified service personnel should perform maintenance on the Liebert PPC. All voltage sources to the unit must be disconnected before inspecting or cleaning within the cabinet.

Lethal voltages exist within the equipment during operation. Observe all warnings and cautions in this manual. Failure to comply may result in serious injury or death. Obtain qualified service for this equipment as instructed.

The monitoring system contains a lithium battery for memory backup. Danger of explosion if battery is incorrectly replaced. Replace only with same or equivalent type. Dispose of used batteries according to manufacturer's instructions.

WARNING

Risk of electric shock. Can cause injury or death.

All power and control wiring should be installed by licensed electricians and must comply with the NEC and applicable codes.

WARNING

Risk of improper handling. Can cause equipment damage, injury or death.

The Liebert PPC is heavy; its weight ranges from 400lb. (182kg) to 2450lb. (1111kg) The unit should not be loosened from the shipping pallet until after all handling by forklift or pallet jack is completed

ELECTROMAGNETIC COMPATIBILITY—The Liebert PPC complies with the limits for a Class A digital device, pursuant to Part 15 of FCC rules.

Operation is subject to the following conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

Operating this device in a residential area is likely to cause harmful interference that users must correct at their own expense.

The Liebert PPC complies with the requirements of EMC Directive 2004/108/EC and the published technical standards. Continued compliance requires installation in accordance with these instructions and use of accessories approved by Emerson.

1.0 INSTALLATION INSTRUCTIONS

1.1 Unpacking and Installation

NOTE
Read the entire manual before installing and operating the system. Upon receipt of a Liebert PPC, the installer should perform the following steps to assure a quality installation.

1.1.1 Unpacking and Preliminary Inspection

A high-quality installation begins on the receiving dock.

1. Inspect for damage or signs of mishandling before unpacking the unit(s). Check Shock-Watch™ indicator.
2. If the Liebert PPC was shipped in an export crate, open the shipping crate carefully. (Use care to avoid puncturing the container with sharp objects that would damage the contents.)
3. Remove the packing and vapor barrier and inspect the equipment for any obvious shipping damages.

NOTE
The units should not be loosened from the shipping pallet until after all handling by fork lift or pallet jack is completed. Complete internal inspection should be accomplished only after equipment positioning and prior to electrical hookup.

If any shipping damage is observed, immediately file a damage claim with the shipping agency and forward copy to:

Liebert Corporation
1050 Dearborn Drive
P.O. Box 29186
Columbus, Ohio 43229 USA

1.1.2 Handling Considerations

The Liebert PPC is bolted to a wooden pallet to allow handling by fork lift equipment.

Easily moved—The Liebert PPC sits on casters that allow the unit to be rolled into place after it has been unbolted from the pallet.

Check size and weight—Refer to the cabinet drawings furnished with the unit for size and weight information. Typical cabinet dimensions and weights are shown in **Figure 1** and **Figure 2**.

Plan the route—The route that the unit will follow to its installation area should be planned to ensure that all passages are large enough to accommodate the unit, and that the floors are adequate to support the weight. (For example: Are the doorway, elevators, ramps, etc., adequate? Are there any non-negotiable corners or offsets in the hallways?)

Move with care—To prevent panel damage, Emerson recommends removing the exterior panels before moving the unit. Reconnect all panel ground wires when replacing panels.

Figure 1 Typical cabinet and floor planning dimensions, sidecar

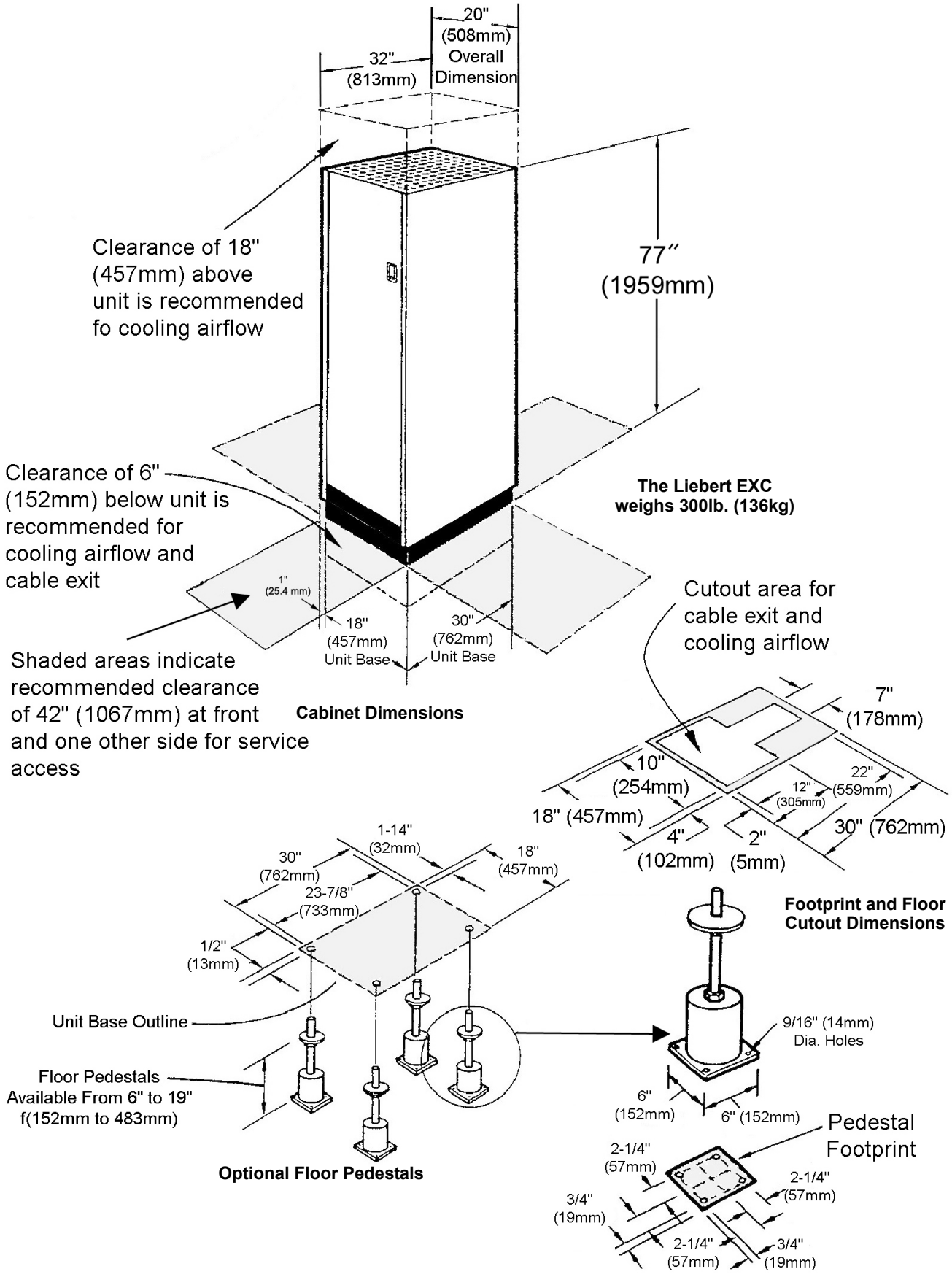
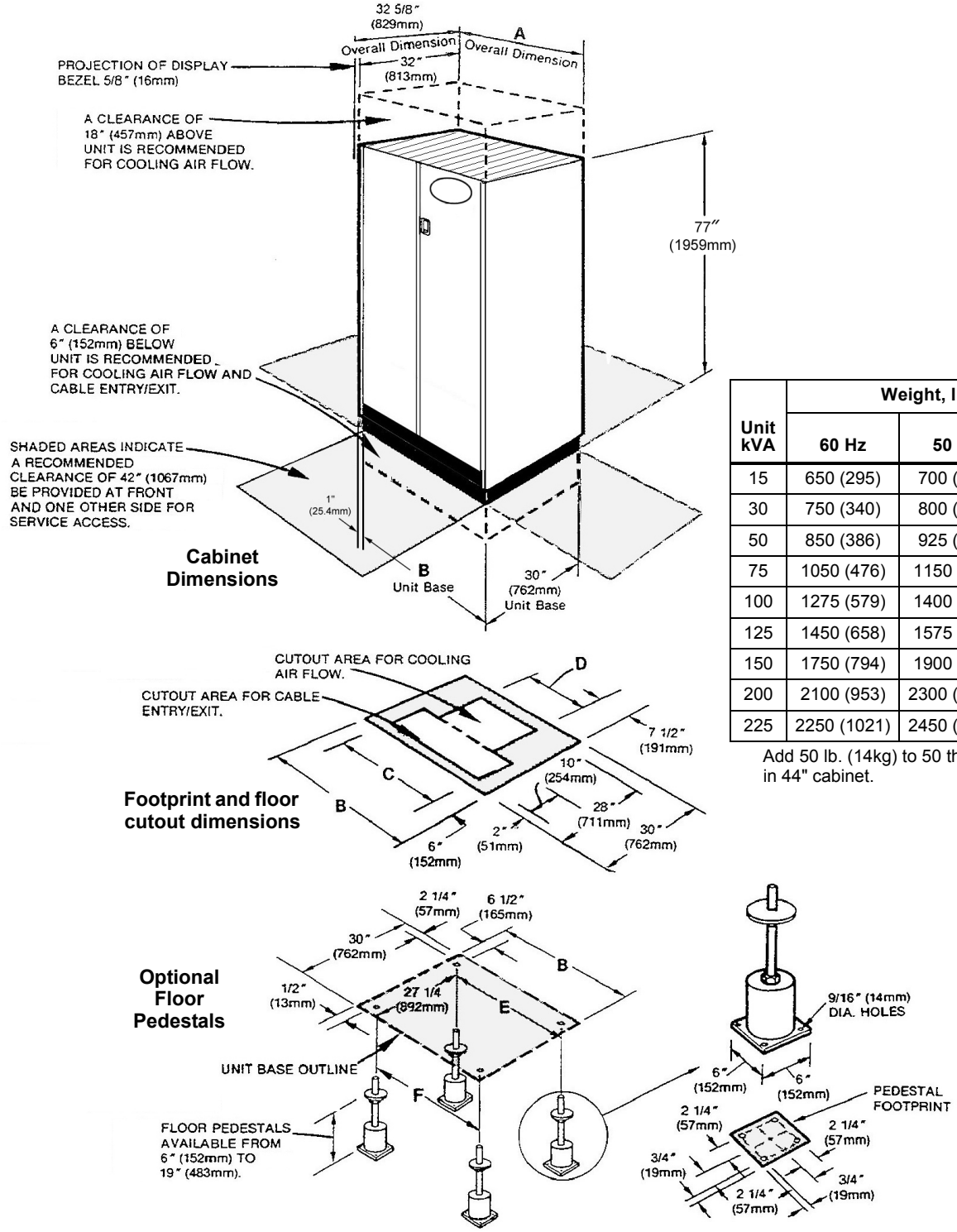


Figure 2 Typical cabinet and floor planning dimension data

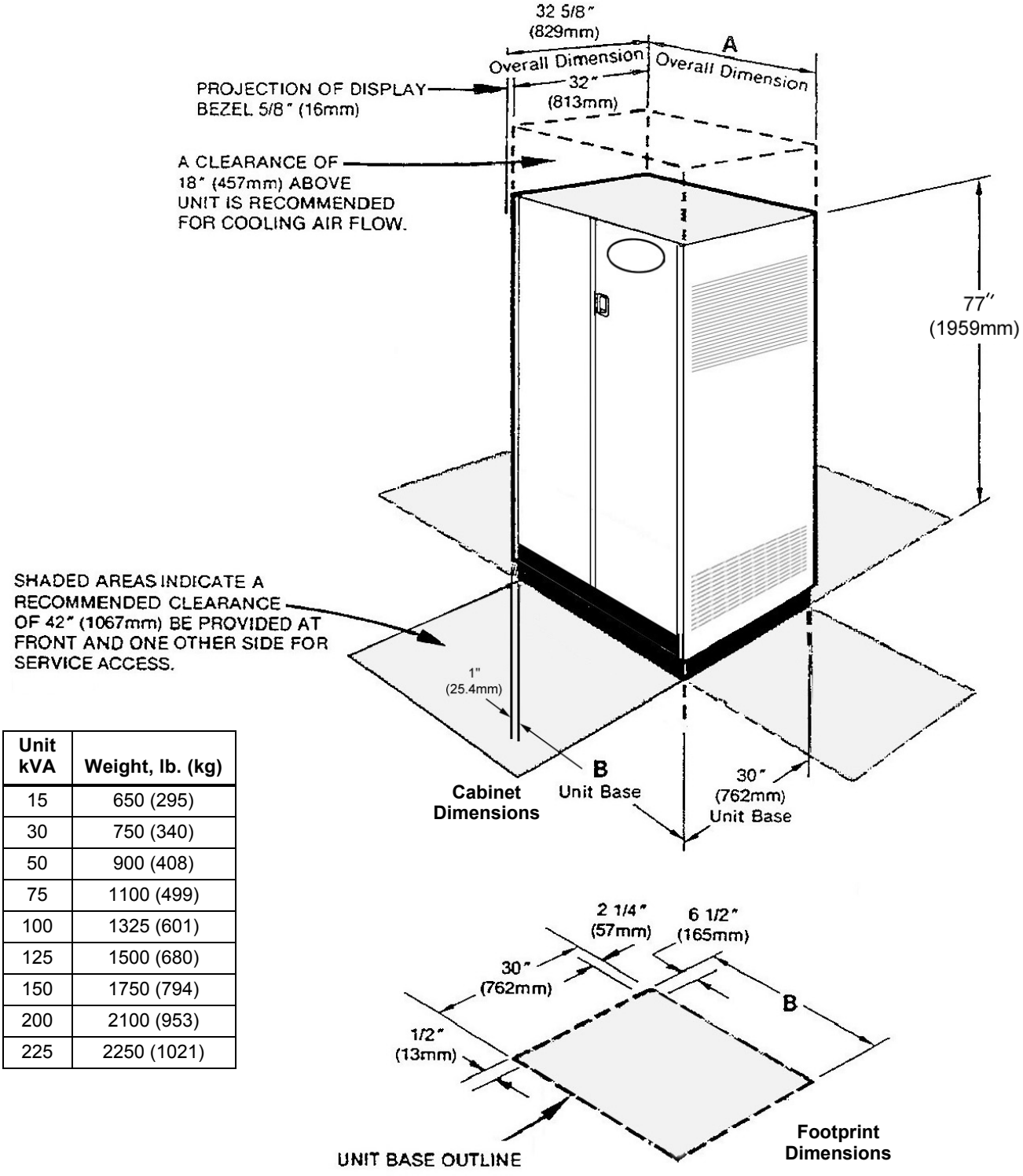


Unit kVA	Weight, lb. (kg)		
	60 Hz	50 Hz	Without Xfmr
15	650 (295)	700 (318)	400 (182)
30	750 (340)	800 (363)	400 (182)
50	850 (386)	925 (420)	400 (182)
75	1050 (476)	1150 (522)	400 (182)
100	1275 (579)	1400 (635)	450 (204)
125	1450 (658)	1575 (715)	450 (204)
150	1750 (794)	1900 (862)	700 (318)
200	2100 (953)	2300 (1043)	700 (318)
225	2250 (1021)	2450 (1111)	700 (318)

Add 50 lb. (14kg) to 50 thru 125 kVA units in 44" cabinet.

Unit kVA	No. of Panelboards	Dimensions, in. (mm)					
		A	B	C	D	E	F
15 to 125	1	32 (813)	30 (762)	18 (457)	15 (381)	17 (432)	29 (737)
150 to 225	2	44 (1118)	42 (1067)	30 (762)	27 (686)	29 (737)	41 (1041)

Figure 3 Typical cabinet and floor planning dimension data, top exit unit



Unit kVA	Weight, lb. (kg)
15	650 (295)
30	750 (340)
50	900 (408)
75	1100 (499)
100	1325 (601)
125	1500 (680)
150	1750 (794)
200	2100 (953)
225	2250 (1021)

Unit kVA	No. of Panelboards	Dimensions, in. (mm)	
		A	B
15-125	1	32 (813)	30 (762)
150-225	1	44 (1118)	42 (1067)

1.1.3 Unit Preparation

The Liebert PPC may be easily removed from the shipping pallet and installed by customer personnel. A typical procedure is as follows:

1. Set the palletized assembly in a level area, where there is enough room to roll the unit and entire cable assembly off the pallet onto the floor.
2. Cut the shipping bands.

WARNING

Risk of cutting bands under tension. Can cause injury or death.

The shipping bands may be under tension. Use appropriate eye, face and hand protection to safeguard against injury from band backlash.

3. Remove the factory-provided ramp from its shipping position—packed in front of the unit. Place the ramp adjacent to the pallet to provide a smooth path from pallet to floor.
4. Remove side and rear panels from the module. An Allen wrench for the side panels is furnished in the installation packet. (Carefully disconnect panel ground wires by pulling the easy-disconnect terminals at the unit frame.)
5. Remove the bolts holding the unit to the shipping pallet. (Located in each of the four bottom corners.)
6. Remove shipping blocks from under unit, then remove chocks from all casters.
7. Roll unit off pallet onto floor.
8. Roll unit to its installation location. For units located on a raised floor, use care when positioning unit over the floor cutout to avoid casters falling through the cutout.

NOTE

*Before maneuvering the unit into its final position, read and follow all advisories in the following paragraphs in **1.1.4 Location Considerations**.*

1.1.4 Location Considerations

The Liebert PPC should be located within the computer room, and/or close to the load(s) which it is supplying.

Equipment Location should employ the shortest output distribution cable runs consistent with logical equipment arrangement and allowances for future additions.

Operating Environment—Ambient temperatures of 32°F to 104°F (0°C to 40°C) with a relative humidity of 0% to 95% (non-condensing).

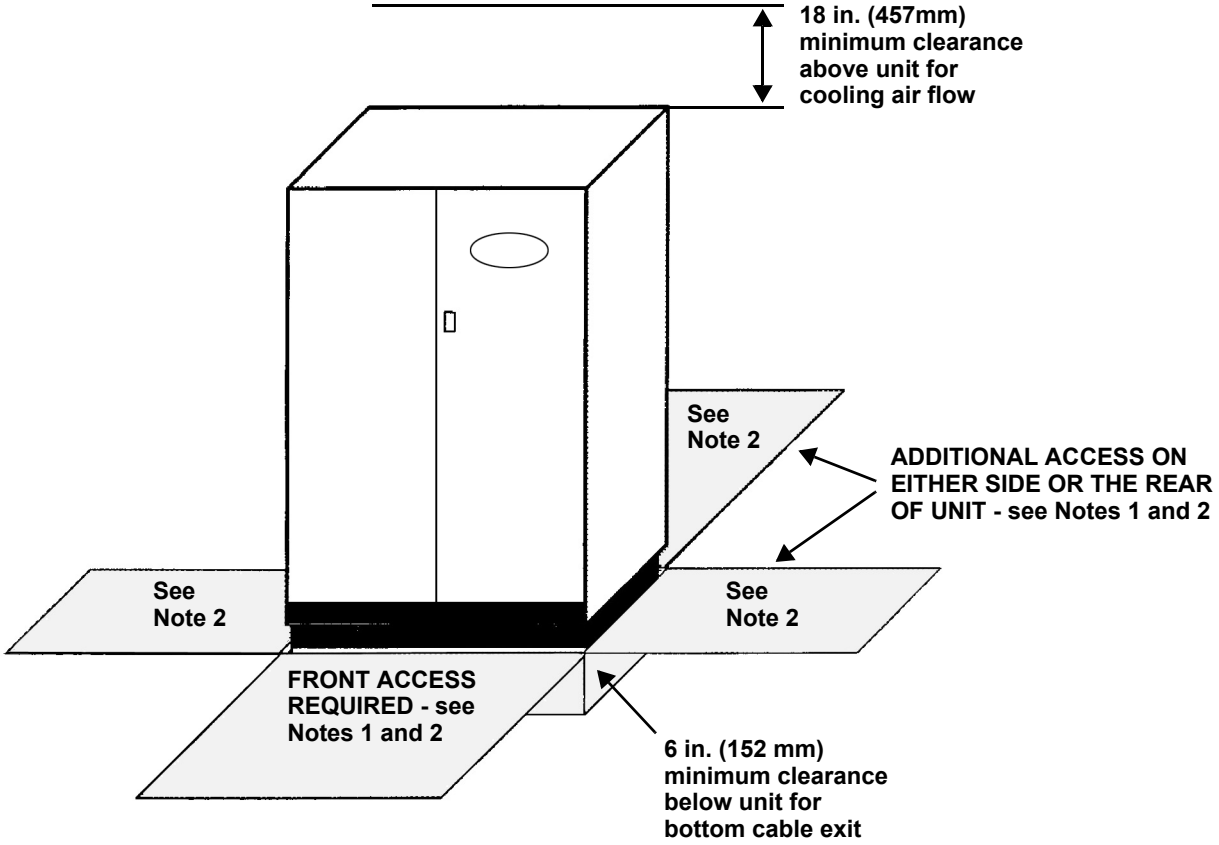
Bottom Clearance is required for exit of cables/conduit and/or for cooling air flow. This clearance is automatically provided by a raised floor (6 in. / 150 mm minimum height). **Figure 1** and **Figure 2** show the typical raised-floor cutout dimensions.

When units are not located on a raised floor (or if the raised floor is not adequate to support the unit), optional floor pedestals may be used. (Non-raised floor applications are not CSA approved.) Units with top cable exit provisions and side vents do not require bottom clearance.

Recommended Minimum Service Clearances are shown in **Figure 4**. The indicated clearances at the front and one other side or rear of the unit are required for service access by the National Electrical Code (NEC) (Article 110-16). Clearance above the unit is required for cooling air flow (exhaust).

Heat Output—As do all electrical devices, the Liebert PPC produces heat under normal operation. (See **Table 1**.) This heat output should be included when calculating the environmental conditions of the room.

Figure 4 Recommended minimum service and ventilation clearances



NOTES:

1. Service access is required at the front, plus one other side or rear.
2. Service access clearance:
   36 in. (914 mm) for units up to 150 volts to ground
   42 in. (1067 mm) for units over 150 volts to ground

Table 1 Heat output

Full Load Heat Output, BTU/hr (kW)	
kVA	**BTU/hr (kW)**
15	2,500 (0.73)
30	4,600 (1.35)
50	6,200 (1.82)
75	8,150 (2.39)
100	9,900 (2.90)
125	11,500 (3.37)
150	12,500 (3.66)
200	15,500 (4.54)
225	15,800 (4.63)

1.1.5 Floor Pedestal Installation

Floor pedestals are optional equipment intended to provide clearance for bottom cable entry without relying on a raised floor to support the unit. The pedestals are adjustable over a limited range (approximately 3-1/2 in.) to allow leveling the unit and minor adjustments in the unit's installed height.

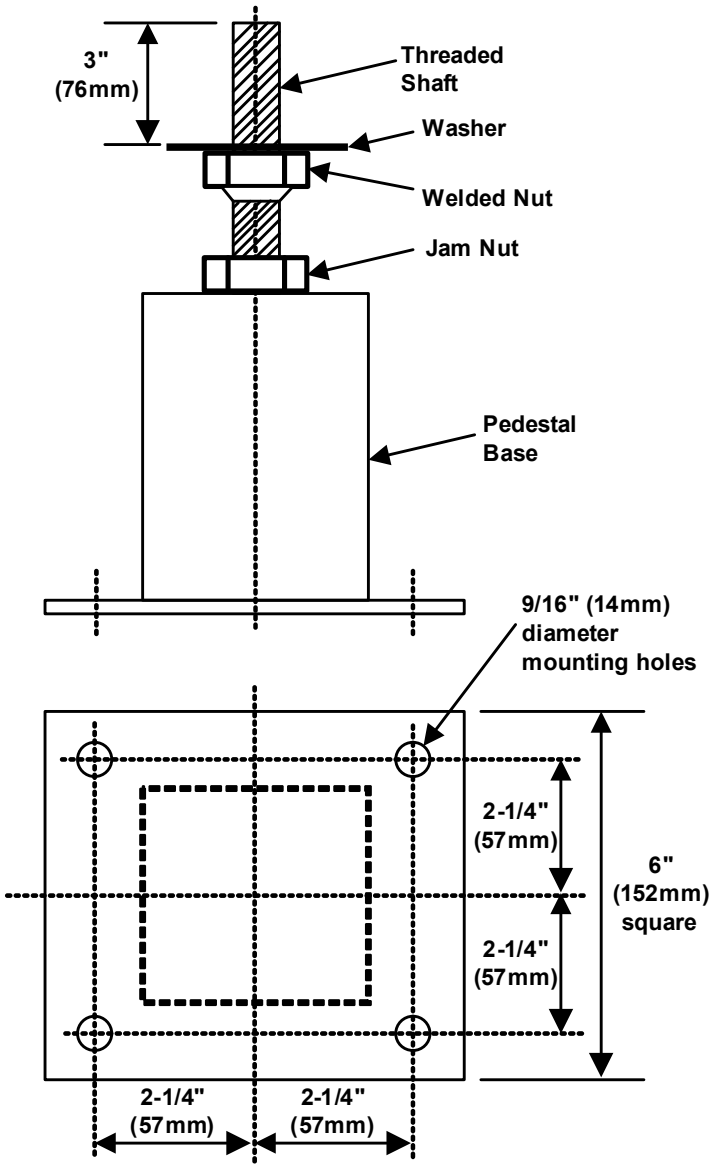
NOTE

Floor pedestals may be reverse-assembled for shipping. Before installation, reassemble the pedestals as shown in ***Figure 5****. When the pedestal is properly assembled, the washer on top of the welded nut provides a bearing surface for the unit's weight.*

1. Insert the pedestal threaded shaft into the inside corner tubing of the cabinet base as shown in **Figure 1** and **Figure 2**.
2. Adjust the pedestal height by turning the welded nut/shaft assembly into or out of the pedestal base as required.
3. Lock the height by tightening the jam nut against the pedestal base.

The pedestal may be secured to the floor by means of the four holes in the base. Locations of floor pedestals are shown in **Figure 1** and **Figure 2**.

Figure 5 Floor pedestal details



1.2 Distribution Sidecar Mounting and Wiring

For Liebert PPC units with more than two panelboards, the additional panelboards are furnished in side-mounted enclosures that are shipped separate from the main unit.

1.2.1 Sidecar Mounting

The additional distribution sidecar is 18 in. x 30 in. (457x762mm) and can be mounted on either the left or right side of the main unit, with left side mounting recommended.

1. Provide a floor cutout for exit of output cables, as shown in **Figure 1**.
2. Remove the side panel, the upper panel retainers and the lower panel hooks from the main unit.
3. Align the distribution sidecar with the main unit and bolt the two frames together using the four bolts and hardware provided.
4. If floor pedestals are used for the main unit, two additional floor pedestals are required for the outside corners of the sidecar. See **Figure 1**.
5. Install the upper panel retainers and lower panel hooks on the side-car enclosure.
6. After electrical connections are completed, install the unit side panel on the sidecar.

1.2.2 Sidecar Electrical Connections

Five conductors (3-phase conductors, neutral and ground) are furnished with the distribution sidecar for connection to the main unit in the field, along with an intercabinet frame ground conductor.

For Liebert PPCs with transformers, the sidecar phase conductors are connected directly to the transformer terminals:

Phase A (wire 412) to X1
Phase B (wire 422) to X2
Phase C (wire 432) to X3

The sidecar neutral (wire 442) and ground (wire 452) conductors are connected to the Liebert PPC main ground busbar (see unit wiring diagram).

For Liebert PPC's without transformers, the sidecar phase and neutral conductors are connected to the corresponding output power distribution terminal blocks inside the main unit. The sidecar ground conductor is connected to the main ground busbar.

For all Liebert PPC's with VPMP monitoring, route each sidecar conductor through the appropriate current transformer (CT) in the main unit.

NOTE
Sidecar conductors must pass through the current transformers in the same direction as the main unit panelboard conductors. Use the existing main unit panelboard wiring for reference.

1.3 Power and Control Wiring

Power and control wiring should be installed by licensed electricians. All power and control wiring must comply with the NEC and applicable local codes.

1.3.1 Input Power Connections

If the unit is furnished with junction boxes, input power connections are made as detailed in **1.3.2 Junction Box Installation (If Used)**.

If junction boxes are not furnished, the input power feeder is connected to the input power lugs or blocks located inside the unit. (See **Figure 6**, **Figure 8**, and **Figure 10**.)

WARNING

Risk of electric shock. Can cause injury or death.

Verify that all incoming line voltage (power) and low-voltage (control) circuits are de-energized and locked out before installing cables or making connections, whether in the junction box or in the unit.

To minimize disturbances caused by other loads in the building, the 3-phase power input to the unit should be supplied directly from the service entrance or other power source (a dedicated power feeder).

The input feeder circuit should be sized in accordance with the NEC and any local building codes to assure the feeder's ability to safely carry the system's full load current, including losses.

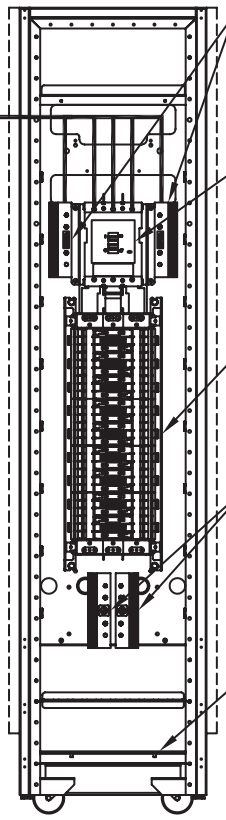
Input feeder conductors should be sized for no more than 2% voltage drop. If operation at undervoltage conditions for extended periods of time is desired, the input feeders must be oversized.

Typical conductor size data is shown in **Table 2**. All connections must comply with the NEC and all other applicable codes.

For units with a transformer, the main input feeder should consist of 3-phase conductors and one (safety) ground conductor (3W + G).

For units without a transformer, the main input feeder must consist of 3-phase conductors, one neutral, and one (safety) ground conductor (4W + G).

Figure 6 Electrical connection locations, sidecar unit



Interconnection Wiring
provided by factory

Neutral Connections
Distribution Cables Neutral(s) connected to distribution panelboard neutral busbar

Panelboard Main Circuit Breaker
Factory-Wired

Distribution Panelboard

Ground Connections
Distribution Cable Ground(s) connected to distribution panelboard ground busbar

Distribution Cable Conduit Connection
Cable Tray 1-3/32" (27.8mm) holes for 3/4" conduit fittings and 7/8" (22.2mm) holes for 1/2" conduit fittings provided for securing optional distribution cables

NOTES
1. The unit bolts to the main Liebert Precision Power Center. See installation manual for instructions.
2. Site panel is taken from the Liebert PPC and installed to either the left or right side of the unit.

FRONT VIEW WITH DOOR OPEN AND PANEL REMOVED

PPC15010
Rev. 2

Figure 7 Electrical connection location for 72-pole Square D or 54-pole GE panelboards, 32" cabinet, bottom entry/exit

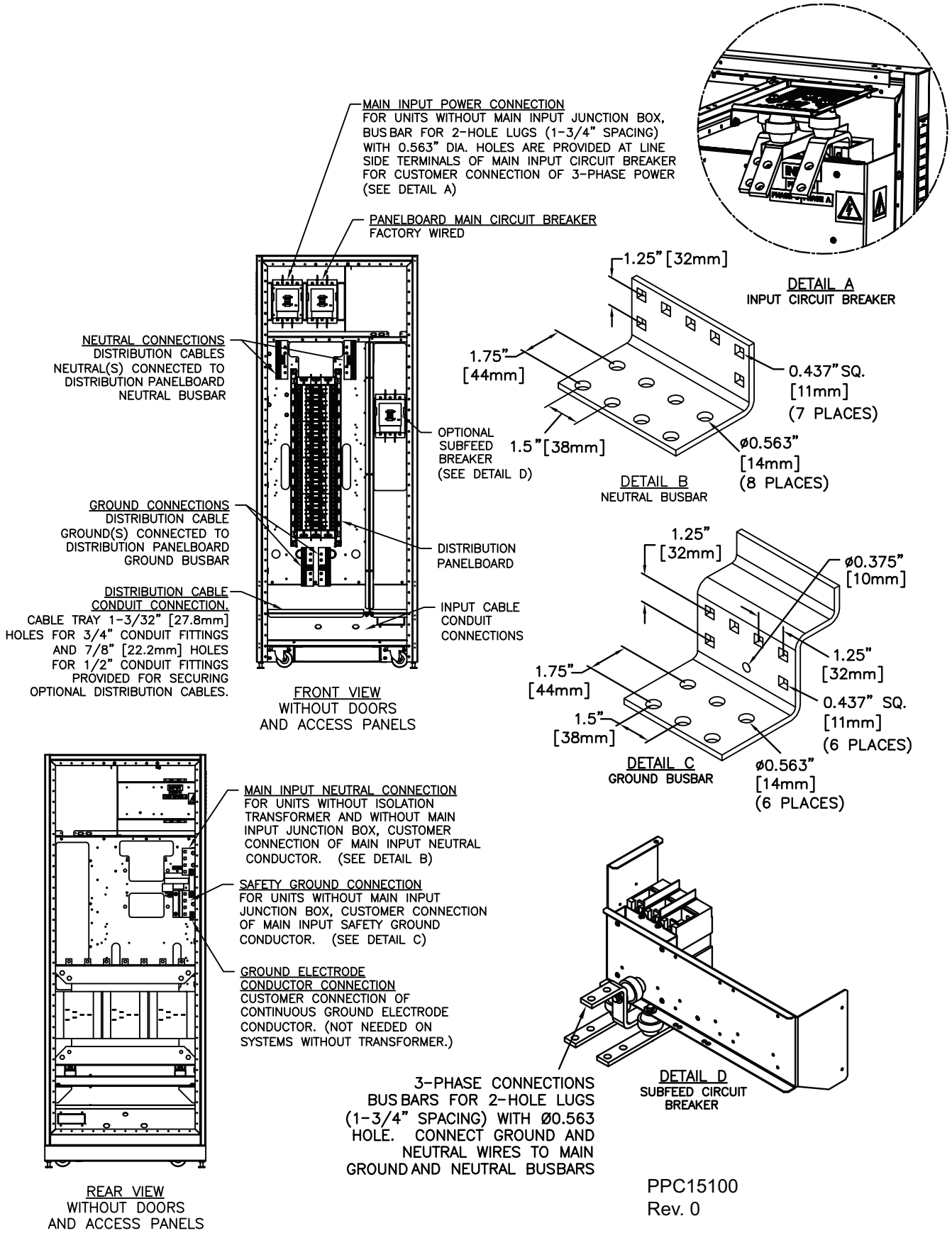

MAIN INPUT POWER CONNECTION
FOR UNITS WITHOUT MAIN INPUT JUNCTION BOX, BUS BAR FOR 2-HOLE LUGS (1-3/4" SPACING) WITH 0.563" DIA. HOLES ARE PROVIDED AT LINE SIDE TERMINALS OF MAIN INPUT CIRCUIT BREAKER FOR CUSTOMER CONNECTION OF 3-PHASE POWER (SEE DETAIL A)
PANELBOARD MAIN CIRCUIT BREAKER FACTORY WIRED
NEUTRAL CONNECTIONS
DISTRIBUTION CABLES NEUTRAL(S) CONNECTED TO DISTRIBUTION PANELBOARD NEUTRAL BUSBAR
OPTIONAL SUBFEED BREAKER (SEE DETAIL D)
GROUND CONNECTIONS
DISTRIBUTION CABLE GROUND(S) CONNECTED TO DISTRIBUTION PANELBOARD GROUND BUSBAR
DISTRIBUTION PANELBOARD
DISTRIBUTION CABLE CONDUIT CONNECTION.
CABLE TRAY 1-3/32" [27.8mm] HOLES FOR 3/4" CONDUIT FITTINGS AND 7/8" [22.2mm] HOLES FOR 1/2" CONDUIT FITTINGS PROVIDED FOR SECURING OPTIONAL DISTRIBUTION CABLES.
INPUT CABLE CONDUIT CONNECTIONS
FRONT VIEW
WITHOUT DOORS
AND ACCESS PANELS
1.25" [32mm]
DETAIL A
INPUT CIRCUIT BREAKER
1.75" [44mm]
0.437" SQ. [11mm] (7 PLACES)
1.5" [38mm]
ø0.563" [14mm] (8 PLACES)
DETAIL B
NEUTRAL BUSBAR
1.25" [32mm]
ø0.375" [10mm]
1.25" [32mm]
1.75" [44mm]
0.437" SQ. [11mm] (6 PLACES)
1.5" [38mm]
ø0.563" [14mm] (6 PLACES)
DETAIL C
GROUND BUSBAR
MAIN INPUT NEUTRAL CONNECTION
FOR UNITS WITHOUT ISOLATION TRANSFORMER AND WITHOUT MAIN INPUT JUNCTION BOX, CUSTOMER CONNECTION OF MAIN INPUT NEUTRAL CONDUCTOR. (SEE DETAIL B)
SAFETY GROUND CONNECTION
FOR UNITS WITHOUT MAIN INPUT JUNCTION BOX, CUSTOMER CONNECTION OF MAIN INPUT SAFETY GROUND CONDUCTOR. (SEE DETAIL C)
GROUND ELECTRODE CONDUCTOR CONNECTION
CUSTOMER CONNECTION OF CONTINUOUS GROUND ELECTRODE CONDUCTOR. (NOT NEEDED ON SYSTEMS WITHOUT TRANSFORMER.)
REAR VIEW
WITHOUT DOORS
AND ACCESS PANELS
3-PHASE CONNECTIONS
BUS BARS FOR 2-HOLE LUGS (1-3/4" SPACING) WITH Ø0.563 HOLE. CONNECT GROUND AND NEUTRAL WIRES TO MAIN GROUND AND NEUTRAL BUSBARS
DETAIL D
SUBFEED CIRCUIT BREAKER
PPC15100
Rev. 0

Figure 8 Electrical connection locations, for 54-pole Square D or 42-pole GE panelboard, 32" cabinet, bottom entry/exit

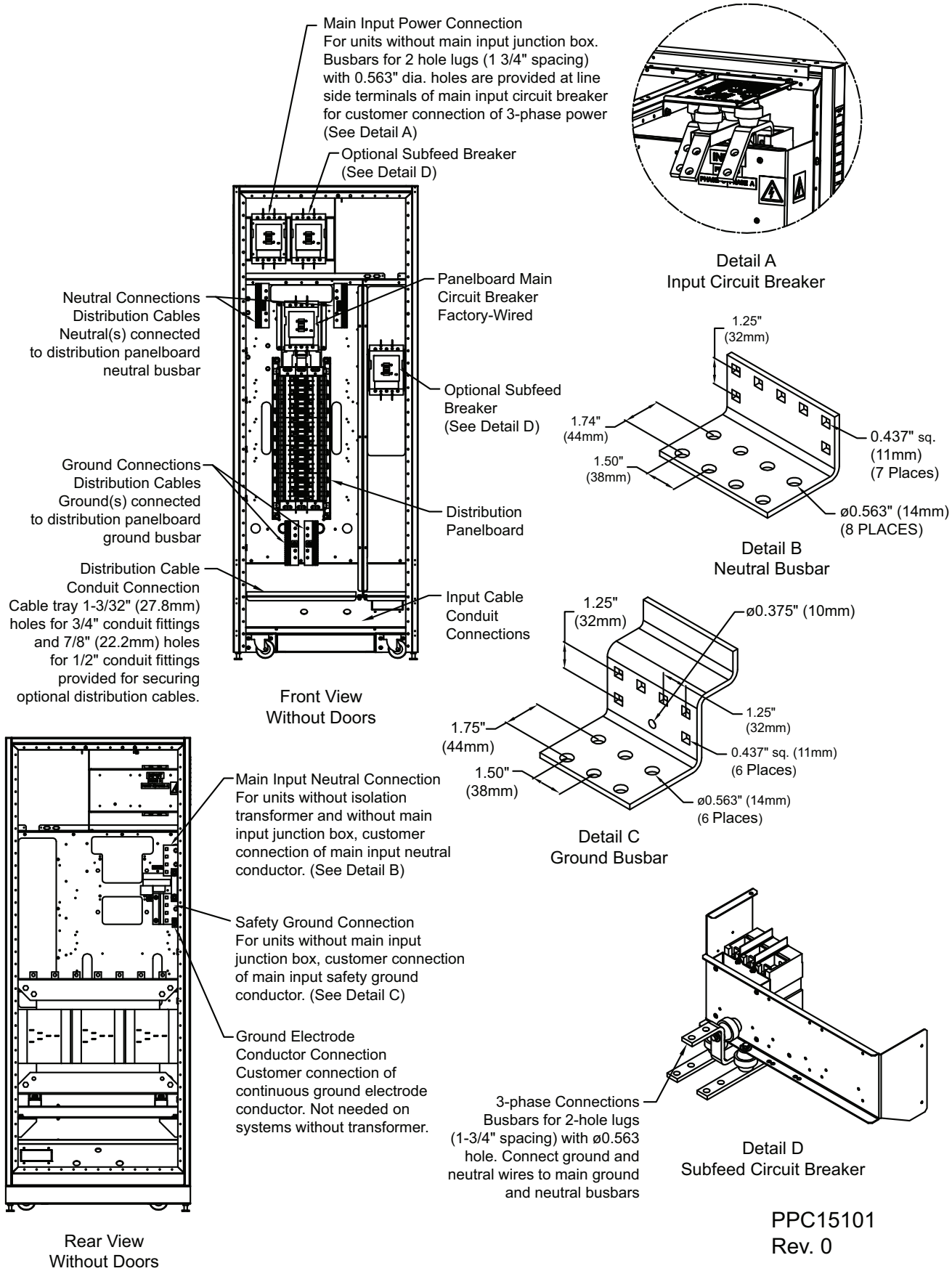

Main Input Power Connection
For units without main input junction box. Busbars for 2 hole lugs (1 3/4" spacing) with 0.563" dia. holes are provided at line side terminals of main input circuit breaker for customer connection of 3-phase power (See Detail A)
Optional Subfeed Breaker (See Detail D)
Neutral Connections Distribution Cables Neutral(s) connected to distribution panelboard neutral busbar
Panelboard Main Circuit Breaker Factory-Wired
Optional Subfeed Breaker (See Detail D)
Ground Connections Distribution Cables Ground(s) connected to distribution panelboard ground busbar
Distribution Panelboard
Distribution Cable Conduit Connection Cable tray 1-3/32" (27.8mm) holes for 3/4" conduit fittings and 7/8" (22.2mm) holes for 1/2" conduit fittings provided for securing optional distribution cables.
Input Cable Conduit Connections
Front View Without Doors
Detail A Input Circuit Breaker
1.25" (32mm)
1.74" (44mm)
1.50" (38mm)
0.437" sq. (11mm) (7 Places)
ø0.563" (14mm) (8 PLACES)
Detail B Neutral Busbar
1.25" (32mm)
ø0.375" (10mm)
1.75" (44mm)
1.50" (38mm)
1.25" (32mm)
0.437" sq. (11mm) (6 Places)
ø0.563" (14mm) (6 Places)
Detail C Ground Busbar
Main Input Neutral Connection For units without isolation transformer and without main input junction box, customer connection of main input neutral conductor. (See Detail B)
Safety Ground Connection For units without main input junction box, customer connection of main input safety ground conductor. (See Detail C)
Ground Electrode Conductor Connection Customer connection of continuous ground electrode conductor. Not needed on systems without transformer.
Rear View Without Doors
3-phase Connections Busbars for 2-hole lugs (1-3/4" spacing) with ø0.563 hole. Connect ground and neutral wires to main ground and neutral busbars
Detail D Subfeed Circuit Breaker
PPC15101
Rev. 0

Figure 9 Electrical connection location for 72-pole Square D or 54-pole GE panelboard, 44" cabinet, bottom entry/exit

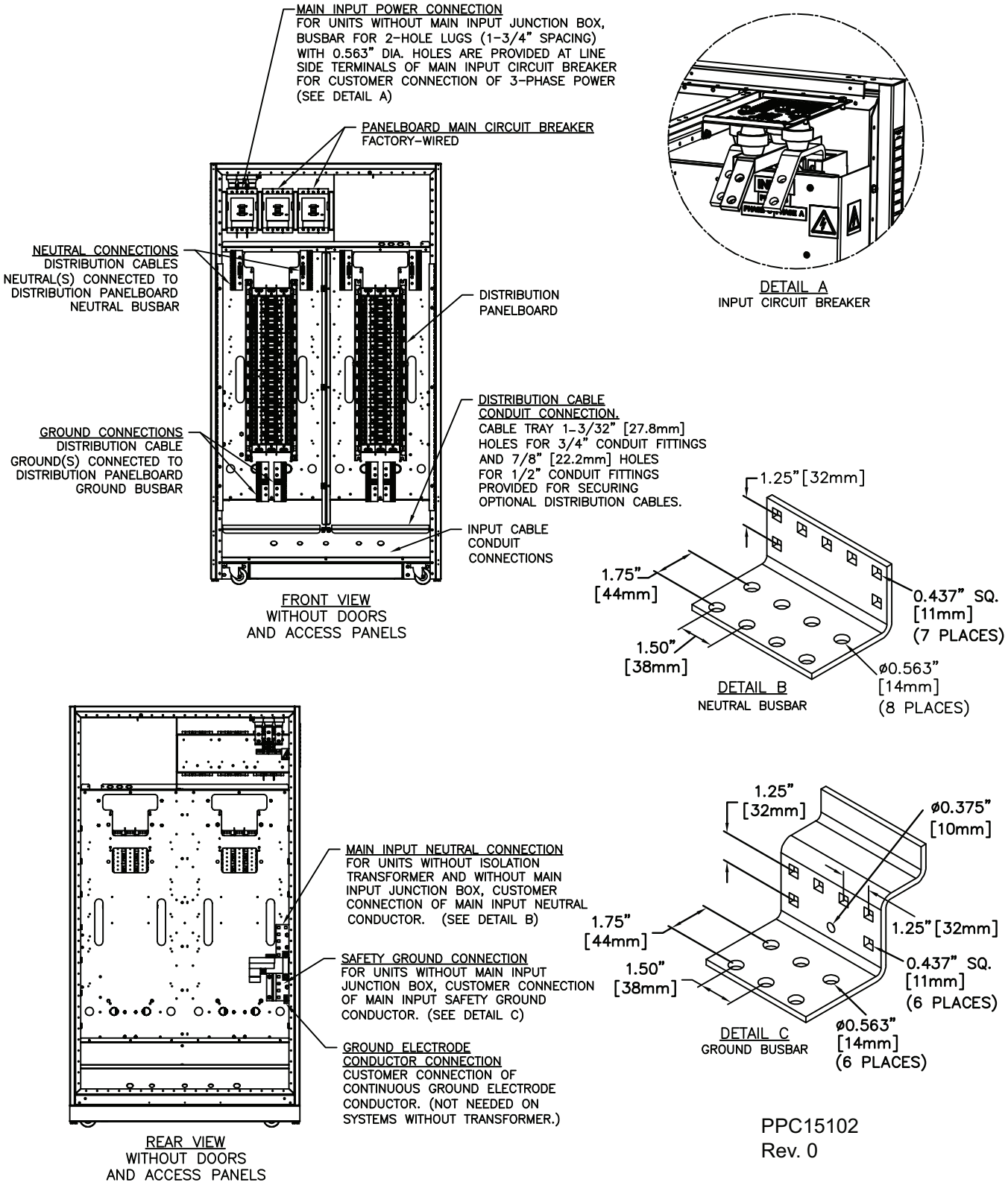

MAIN INPUT POWER CONNECTION
FOR UNITS WITHOUT MAIN INPUT JUNCTION BOX, BUSBAR FOR 2-HOLE LUGS (1-3/4" SPACING) WITH 0.563" DIA. HOLES ARE PROVIDED AT LINE SIDE TERMINALS OF MAIN INPUT CIRCUIT BREAKER FOR CUSTOMER CONNECTION OF 3-PHASE POWER (SEE DETAIL A)
PANELBOARD MAIN CIRCUIT BREAKER FACTORY-WIRED
NEUTRAL CONNECTIONS
DISTRIBUTION CABLES NEUTRAL(S) CONNECTED TO DISTRIBUTION PANELBOARD NEUTRAL BUSBAR
DISTRIBUTION PANELBOARD
GROUND CONNECTIONS
DISTRIBUTION CABLE GROUND(S) CONNECTED TO DISTRIBUTION PANELBOARD GROUND BUSBAR
DISTRIBUTION CABLE CONDUIT CONNECTION.
CABLE TRAY 1-3/32" [27.8mm] HOLES FOR 3/4" CONDUIT FITTINGS AND 7/8" [22.2mm] HOLES FOR 1/2" CONDUIT FITTINGS PROVIDED FOR SECURING OPTIONAL DISTRIBUTION CABLES.
INPUT CABLE CONDUIT CONNECTIONS
FRONT VIEW
WITHOUT DOORS
AND ACCESS PANELS
DETAIL A
INPUT CIRCUIT BREAKER
1.25"[32mm]
1.75" [44mm]
1.50" [38mm]
0.437" SQ. [11mm] (7 PLACES)
ø0.563" [14mm] (8 PLACES)
DETAIL B
NEUTRAL BUSBAR
MAIN INPUT NEUTRAL CONNECTION
FOR UNITS WITHOUT ISOLATION TRANSFORMER AND WITHOUT MAIN INPUT JUNCTION BOX, CUSTOMER CONNECTION OF MAIN INPUT NEUTRAL CONDUCTOR. (SEE DETAIL B)
SAFETY GROUND CONNECTION
FOR UNITS WITHOUT MAIN INPUT JUNCTION BOX, CUSTOMER CONNECTION OF MAIN INPUT SAFETY GROUND CONDUCTOR. (SEE DETAIL C)
GROUND ELECTRODE CONDUCTOR CONNECTION
CUSTOMER CONNECTION OF CONTINUOUS GROUND ELECTRODE CONDUCTOR. (NOT NEEDED ON SYSTEMS WITHOUT TRANSFORMER.)
REAR VIEW
WITHOUT DOORS
AND ACCESS PANELS
1.25" [32mm]
ø0.375" [10mm]
1.75" [44mm]
1.25"[32mm]
1.50" [38mm]
0.437" SQ. [11mm] (6 PLACES)
ø0.563" [14mm] (6 PLACES)
DETAIL C
GROUND BUSBAR
PPC15102
Rev. 0

Figure 10 Electrical connection locations, 54-pole Square D or 42-pole GE panelboard, 44" cabinet, bottom entry/exit

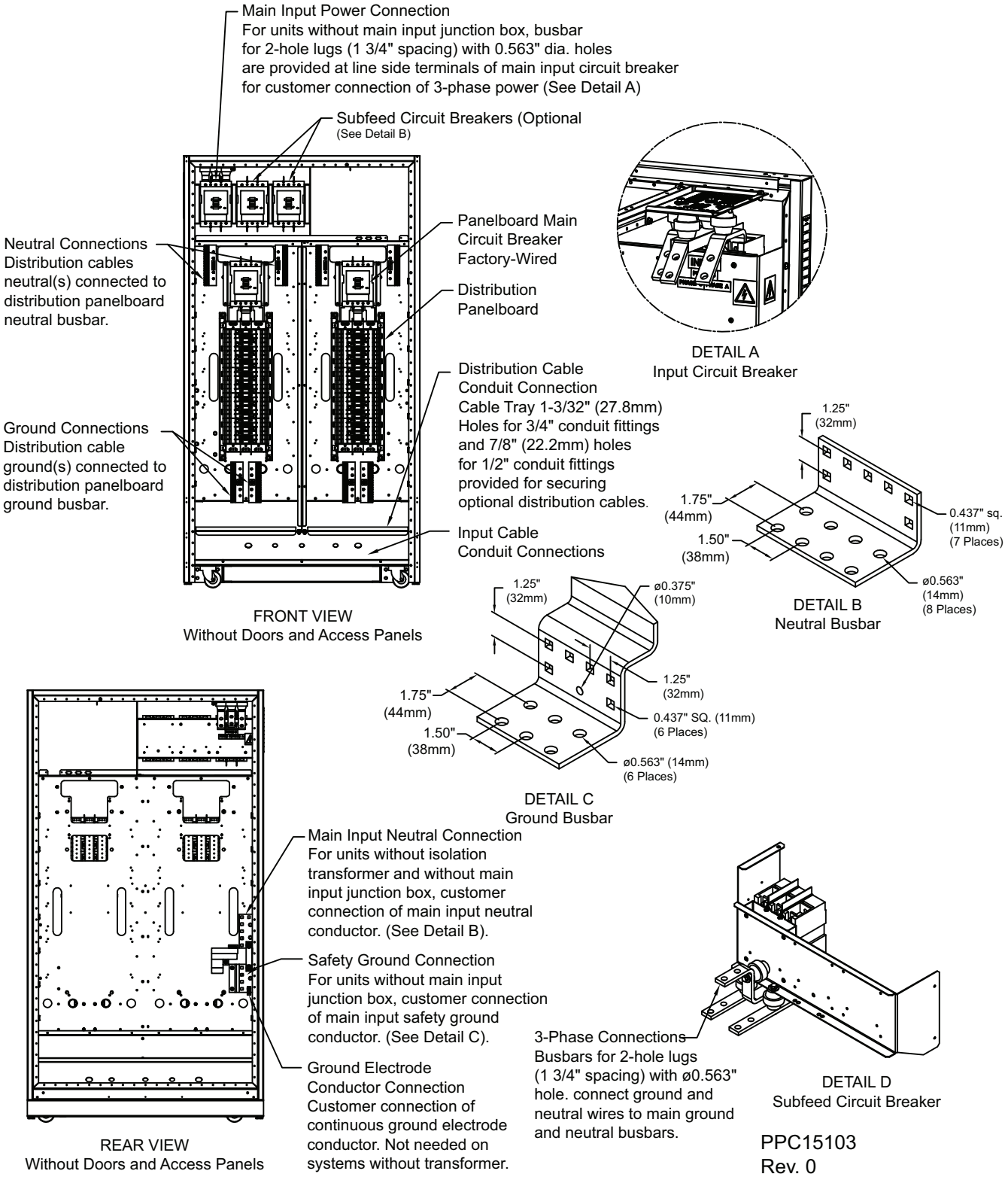

Main Input Power Connection
For units without main input junction box, busbar for 2-hole lugs (1 3/4" spacing) with 0.563" dia. holes are provided at line side terminals of main input circuit breaker for customer connection of 3-phase power (See Detail A)
Subfeed Circuit Breakers (Optional
(See Detail B)
Neutral Connections
Distribution cables neutral(s) connected to distribution panelboard neutral busbar.
Panelboard Main Circuit Breaker Factory-Wired
Distribution Panelboard
Ground Connections
Distribution cable ground(s) connected to distribution panelboard ground busbar.
Distribution Cable Conduit Connection
Cable Tray 1-3/32" (27.8mm) Holes for 3/4" conduit fittings and 7/8" (22.2mm) holes for 1/2" conduit fittings provided for securing optional distribution cables.
Input Cable Conduit Connections
FRONT VIEW
Without Doors and Access Panels
DETAIL A
Input Circuit Breaker
1.25" (32mm)
1.75" (44mm)
1.50" (38mm)
0.437" sq. (11mm) (7 Places)
ø0.563" (14mm) (8 Places)
DETAIL B
Neutral Busbar
1.25" (32mm)
ø0.375" (10mm)
1.75" (44mm)
1.50" (38mm)
1.25" (32mm)
0.437" SQ. (11mm) (6 Places)
ø0.563" (14mm) (6 Places)
DETAIL C
Ground Busbar
Main Input Neutral Connection
For units without isolation transformer and without main input junction box, customer connection of main input neutral conductor. (See Detail B).
Safety Ground Connection
For units without main input junction box, customer connection of main input safety ground conductor. (See Detail C).
Ground Electrode Conductor Connection
Customer connection of continuous ground electrode conductor. Not needed on systems without transformer.
REAR VIEW
Without Doors and Access Panels
3-Phase Connections
Busbars for 2-hole lugs (1 3/4" spacing) with ø0.563" hole. connect ground and neutral wires to main ground and neutral busbars.
DETAIL D
Subfeed Circuit Breaker
PPC15103
Rev. 0

Figure 11 Electrical connection location for 54-pole Square D or 42-pole GE panelboard, 32" cabinet, top entry/exit

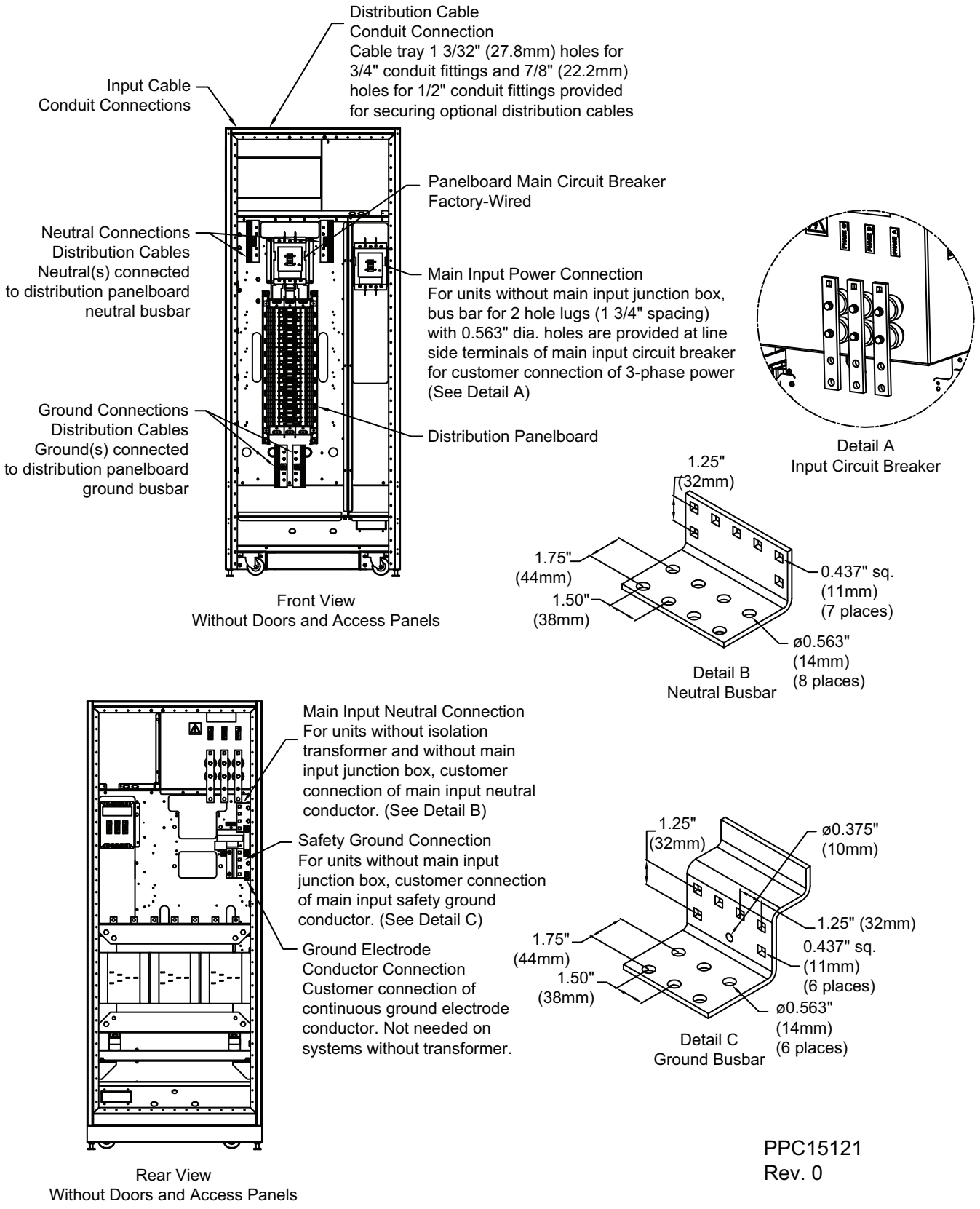


Figure 12 Electrical connection location for 72-pole Square D or 54-pole GE panelboard, 44" cabinet, top entry/exit

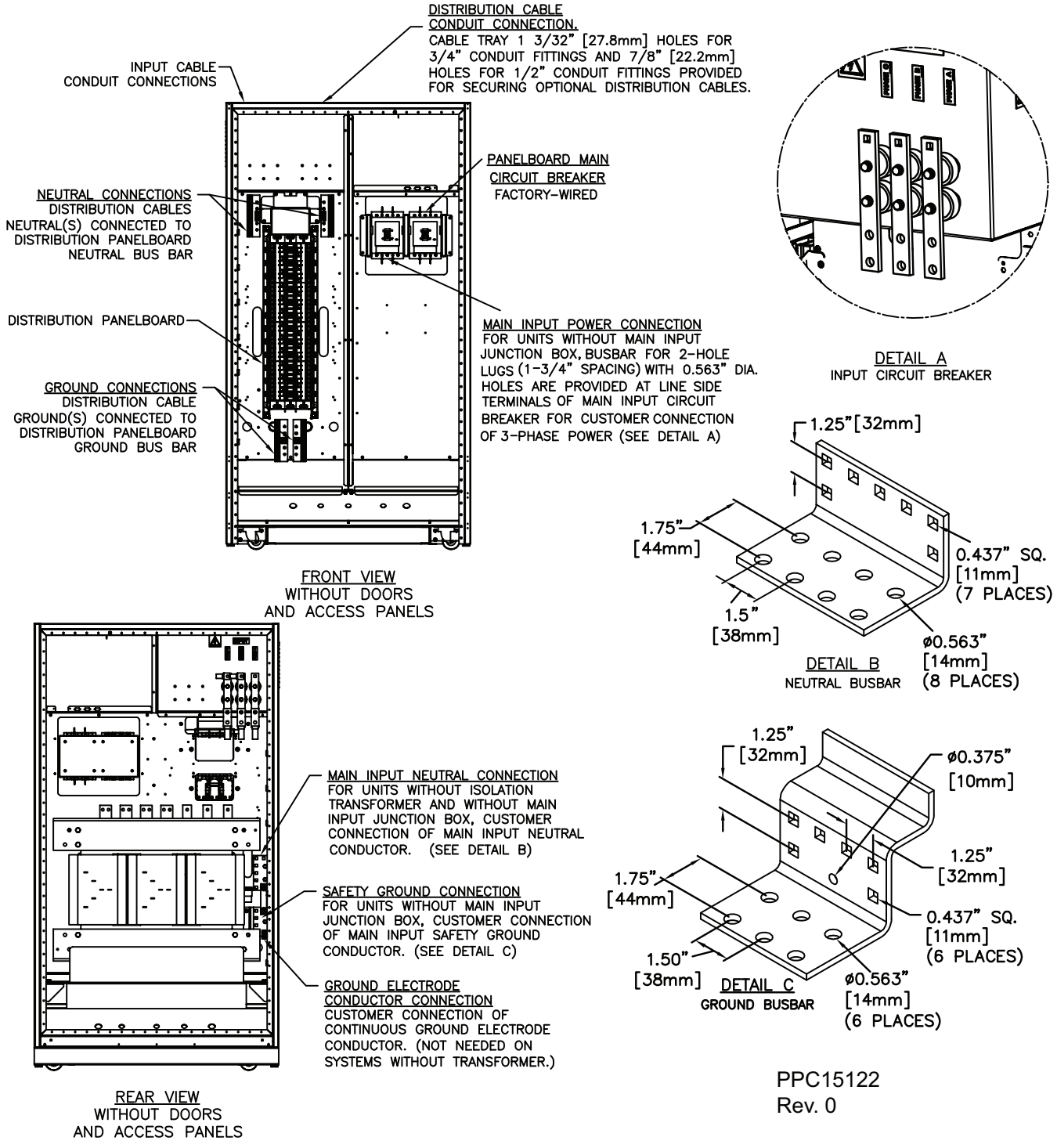

DISTRIBUTION CABLE CONDUIT CONNECTION.
CABLE TRAY 1 3/32" [27.8mm] HOLES FOR 3/4" CONDUIT FITTINGS AND 7/8" [22.2mm] HOLES FOR 1/2" CONDUIT FITTINGS PROVIDED FOR SECURING OPTIONAL DISTRIBUTION CABLES.
INPUT CABLE CONDUIT CONNECTIONS
PANELBOARD MAIN CIRCUIT BREAKER FACTORY-WIRED
NEUTRAL CONNECTIONS DISTRIBUTION CABLES NEUTRAL(S) CONNECTED TO DISTRIBUTION PANELBOARD NEUTRAL BUS BAR
DISTRIBUTION PANELBOARD
GROUND CONNECTIONS DISTRIBUTION CABLE GROUND(S) CONNECTED TO DISTRIBUTION PANELBOARD GROUND BUS BAR
MAIN INPUT POWER CONNECTION FOR UNITS WITHOUT MAIN INPUT JUNCTION BOX, BUSBAR FOR 2-HOLE LUGS (1-3/4" SPACING) WITH 0.563" DIA. HOLES ARE PROVIDED AT LINE SIDE TERMINALS OF MAIN INPUT CIRCUIT BREAKER FOR CUSTOMER CONNECTION OF 3-PHASE POWER (SEE DETAIL A)
FRONT VIEW WITHOUT DOORS AND ACCESS PANELS
DETAIL A INPUT CIRCUIT BREAKER
1.25"[32mm]
1.75" [44mm]
0.437" SQ. [11mm] (7 PLACES)
1.5" [38mm]
ø0.563" [14mm] (8 PLACES)
DETAIL B NEUTRAL BUSBAR
MAIN INPUT NEUTRAL CONNECTION FOR UNITS WITHOUT ISOLATION TRANSFORMER AND WITHOUT MAIN INPUT JUNCTION BOX, CUSTOMER CONNECTION OF MAIN INPUT NEUTRAL CONDUCTOR. (SEE DETAIL B)
SAFETY GROUND CONNECTION FOR UNITS WITHOUT MAIN INPUT JUNCTION BOX, CUSTOMER CONNECTION OF MAIN INPUT SAFETY GROUND CONDUCTOR. (SEE DETAIL C)
GROUND ELECTRODE CONDUCTOR CONNECTION CUSTOMER CONNECTION OF CONTINUOUS GROUND ELECTRODE CONDUCTOR. (NOT NEEDED ON SYSTEMS WITHOUT TRANSFORMER.)
REAR VIEW WITHOUT DOORS AND ACCESS PANELS
1.25" [32mm]
ø0.375" [10mm]
1.25" [32mm]
1.75" [44mm]
0.437" SQ. [11mm] (6 PLACES)
1.50" [38mm]
DETAIL C GROUND BUSBAR
ø0.563" [14mm] (6 PLACES)
PPC15122
Rev. 0

Table 2 Suggested minimum input wire size data

Input Voltage	kVA	Units with Transformers			Transformerless Units		
		Input FLA	Input OPD	Suggested Feeder Wire Size (AWG)	Input FLA	Input OPD	Suggested Feeder Wire Size (AWG)
208V	15	43	60	6	42	60	6
	30	87	106	2	83	106	2
	50	145	200	000	139	175	00
	75	215	295	350 kcmil	208	295	350 kcmil
	100	286	400	(2) 000*	277	350	(2) 00*
	125	358	432	(2) 0000*	347	432	(2) 0000*
	150	427	600	(2) 350 kcmil*	416	600	(2) 350 kcmil*
240V	15	38	50	8	—	—	—
	30	75	100	2			
	50	125	170	00			
	75	186	250	250 kcmil			
	100	248	340	(2) 00*			
	125	310	400	(2) 000*			
	150	370	480	(2) 250 kcmil*			
380V	15	24	30	10	23	30	10
	30	47	59	6	46	59	6
	50	79	100	2	76	100	3
	75	117	150	0	114	150	0
	100	157	200	000	152	200	000
	125	196	250	0000	190	250	250 kcmil
	150	234	295	350 kcmil	228	295	350 kcmil
	200	312	400	(2) 000*	304	400	(2) 000*
	225	351	432	(2) 0000*	342	432	(2) 0000*
400V	15	23	30	10	23	30	10
	30	45	59	6	43	59	6
	50	75	100	2	72	90	2
	75	112	150	0	108	150	0
	100	149	200	000	144	200	000
	125	186	250	250 kcmil	180	225	0000
	150	223	295	350 kcmil	217	295	350 kcmil
	200	297	400	(2) 000*	289	400	(2) 000*
	225	334	432	(2) 0000*	325	432	(2) 0000*
415V	15	22	30	10	21	30	10
	30	43	59	6	42	59	6
	50	72	100	2	70	100	3
	75	108	150	0	104	150	0
	100	143	200	000	139	175	00
	125	179	225	0000	174	225	0000
	150	214	295	350 kcmil	209	295	350 kcmil
	200	285	400	(2) 000*	278	350	(2) 00*
	225	321	432	(2) 0000*	313	432	(2) 000*

Table 2 Suggested minimum input wire size data *(continued)*

Input Voltage	kVA	Units with Transformers			Transformerless Units		
		Input FLA	Input OPD	Suggested Feeder Wire Size (AWG)	Input FLA	Input OPD	Suggested Feeder Wire Size (AWG)
480V	15	19	14	10	—	—	—
	30	38	50	8			
	50	63	80	4			
	75	93	125	1			
	100	124	170	00			
	125	155	200	000			
	150	185	250	250 kcmil			
	200	247	340	(2) 00*			
	225	278	340	(2) 00*			
600V	15	15	20	12	—	—	—
	30	30	40	8			
	50	50	68	4			
	75	74	100	2			
	100	99	125	1			
	125	124	170	00			
	150	148	200	000			
	200	197	250	250 kcmil			
	225	222	295	350 kcmil			

* Parallel feeders per NEC 300-20 and 310-4.

FLA = Full Load Amps of Liebert PPC

OPD = Overcurrent Protection Device inside Liebert PPC

Wire Sizes based on NEC Table 310-16, using 75°C copper conductor.

NOTES:

1. Main input power feeder should be a dedicated feeder direct from service entrance or other power source, if possible.
2. Ground conductors recommended to be insulated conductors run with power conductors for increased system performance. Ground conductor minimum size per NEC Table 250-95. Input power feeder conduit may be used as the safety ground conductor. When conduit is used, adequate electrical continuity must be maintained at conduit connections to enclosures and throughout conduit run.
3. Input feeder wire size listed in this table is the minimum feeder size recommended. Larger wire size may be required because of voltage drop or supply overcurrent protection device.
4. For transformerless units with 3-phase 4W + G input feeder larger wire size may be required because of excessive neutral current (see NEC Table 310-16 notes 8 and 10). For best performance, the unit should be located as close to the load as practical.

Table 3 Main input circuit breaker interrupting rating

Standard Interrupting Rating*				
kVA	208V	480V	380-415V	600V
15-100	100 kA	35 kA	35 kA	25 kA
125-150	100 kA	65 kA	65 kA	50 kA
200-225	—	65 kA	65 kA	50 kA

* Refer to unit specification sheet for units equipped with non-standard main input breakers.

1.3.2 Junction Box Installation (If Used)

Main input (power) and low-voltage (control) junction boxes are available for the Liebert PPC to simplify customer connections.

Shipping Arrangements—The junction boxes, if used, can either be shipped with the system or can be advance-shipped for installation during the roughing-in stage of new construction.

Installation Location—Liebert supplies flexible, 10-foot-long (3 m) cables for connecting the junction boxes to the unit. The junction boxes should be installed a maximum of 8 ft. (2.4m) from the feeder entrance of the unit.

It is recommended that the junction boxes be centered under an easily removable floor tile.

Junction Box Connections must be installed in compliance with the NEC and all other applicable codes.

WARNING

Risk of electric shock. Can cause injury or death.

Verify that incoming line voltage (power) and low-voltage (control) circuits are de-energized and locked out before installing cables or making any connections in the junction box.

Typical junction box connections are shown in **Figure 13** and described in **1.3 Power and Control Wiring**.

Table 4 Main input junction box with transformer electrical connections

Junction Box Size, In. (mm)	Electrical Connections
27 x 14 x 6 (686 x 356 x 152)	400A, 3-Pole Power Block with 1/2 -13 studs on 1-3/4" (44mm) Centers 750A Ground Busbar with Two Sets of 3/8 - 16 Studs on 1.75” Centers
35 x 22 x 6 (889 x 559 x 152)	750A Phase Busbars with 1/2 -13 Studs on 1-3/4" (44mm) Centers 750A Ground Busbar with Two Sets of 3/8 - 16 Studs on 1-3/4" (44mm) Centers

Table 5 Main input junction box without transformer electrical connections (5 wire)

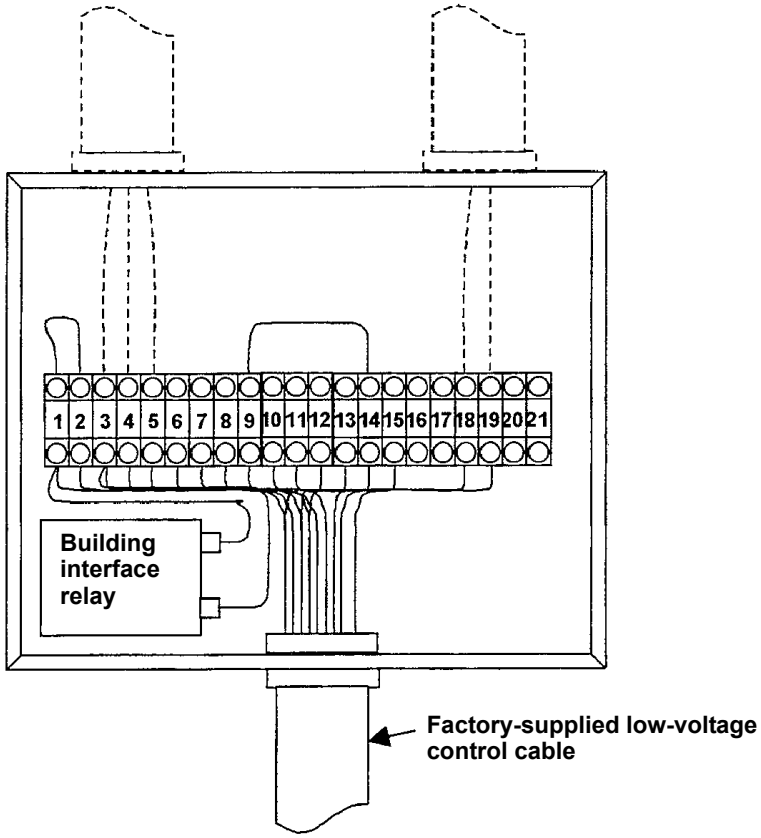
Junction Box Size, In. (mm)	Electrical Connections
27 x 14 x 6 (686 x 356 x 152)	400A 3-Pole Power Block with 1/2 -13 Studs on 1-3/4" (44mm) Centers 750A Neutral Busbar with Two Sets of 1/2 - 13 Studs on 1-3/4" (44mm) Centers 750A Ground Busbar with Two Sets of 3/8 - 16 Studs on 1-3/4" (44mm) Centers
35 x 22 x 6 (889 x 559 x 152)	750A Phase Busbars with 1/2 -13 Studs on 1.75” Centers 1500A Neutral Busbar with Two Sets of 1/2 - 13 Studs on 1-3/4" (44mm) Centers 750A Ground Busbar with Two Sets of 3/8 - 16 Studs on 1-3/4" (44mm) Centers

Dimensions—Dimensions are given on the drawings furnished with the unit. Typical dimensions of the junction boxes are:

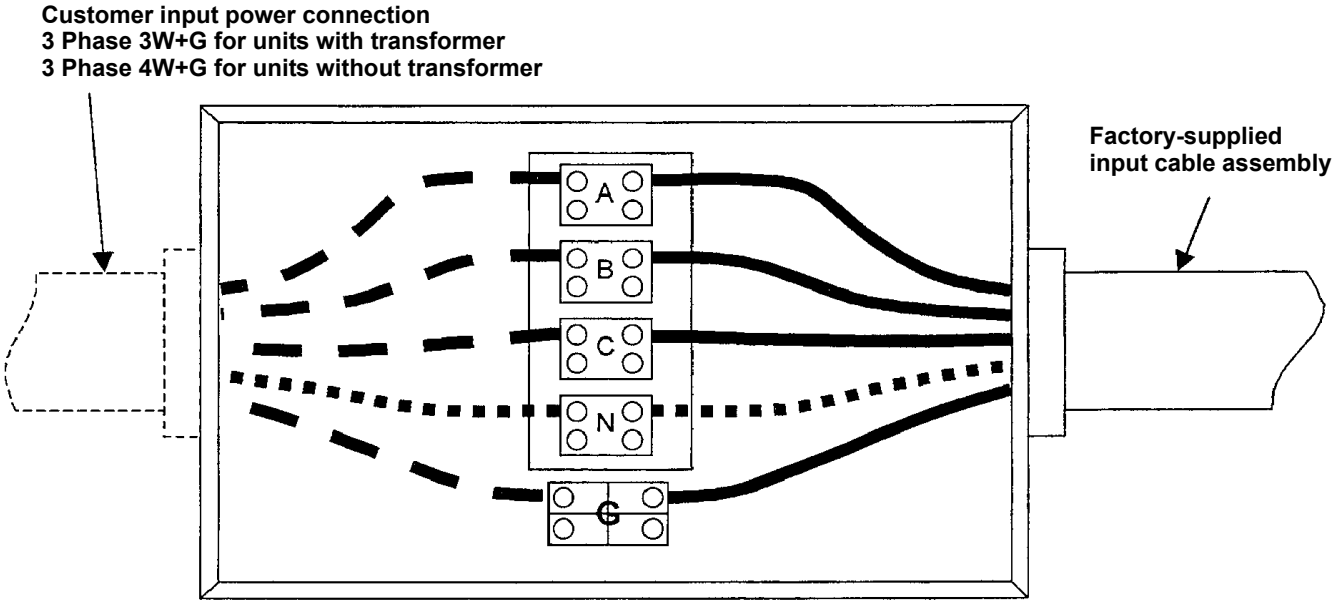
Table 6 Main input (power) junction box dimensions, typical

Unit kVa	Input Voltage		
	208-240V	380-415V	480-600V
15-100 kVA, L x W x H, inches (mm)	27 x 14 x 6 (686 x 356 x (152)		
125-150 kVA, L x W x H, inches (mm)	35 x 22 x 6 (889 x 559 x 152)	27 x 14 x 6 (686 x 356 x (152)	
200 kVA, L x W x H, inches (mm)	N/A	27 x 14 x 6 (686 x 356 x (152)	
225 kVA, L x W x H, inches (mm)	N/A	35 x 22 x 6 (889 x 559 x 152)	27 x 14 x 6 (686 x 356 x (152)

Figure 13 Typical junction box connections



LOW-VOLTAGE CONTROL JUNCTION BOX



MAIN INPUT JUNCTION BOX

1.3.3 System Grounding

The performance and safety of any power conditioning system depend upon proper grounding. **Figure 14** shows the typical grounding arrangements for the Liebert PPC.

Equipment grounding—Grounding is primarily for safety. Correct implementation of grounding also enhances equipment performance. All power feeders must include equipment grounding means as required by the NEC and local codes.

An insulated ground conductor is recommended to be run in each feeder conduit. Ground conductors must be at least the minimum size per NEC Table 250-95. Larger wire sizes may be used for increased system performance.

If the input power feeder conduit is used as a grounding conductor, adequate electrical continuity must be maintained at all conduit connections.

WARNING

Risk of electrical shock. Can cause equipment damage, improper operation, injury and death. Isolating bushings must not be used in a metal conduit run. These busings might prevent the system from being properly grounded.

Signal reference grid—If the unit is used to supply power to a computer room or area that is equipped with a signal reference grid or a grounded raised-floor stringer system, a grounding conductor should be connected from the system ground bus to the grid or floor system. This conductor should be stranded or braided #8 AWG or larger, and as short as practical. Less than 3 ft. (1 m) is recommended.

1.3.4 Grounding Electrode Conductor (Units With Transformer)

Required by code—The Liebert PPC with transformer must be grounded according to the safety practices of NEC 250-26. A local grounding electrode conductor is recommended in addition to the equipment safety ground, which is normally run with the input power conductors.

Unit connection—A terminal is furnished inside the unit for field-connection of the grounding electrode conductor. (See **Figures 6**, **8** and **10**.)

Electrode connection—As shown in **Figure 14**, the grounding electrode conductor is run from the unit to the nearest effectively grounded (in order of preference):

1. Building steel
2. Metal water pipe
3. Other made grounding electrode

Sizing of the grounding electrode conductor is based on the secondary circuit conductors. **Table 7** shows the minimum recommended grounding electrode conductor according to the NEC (Table 250-94).

Table 7 Minimum grounding electrode conductor size (AWG)

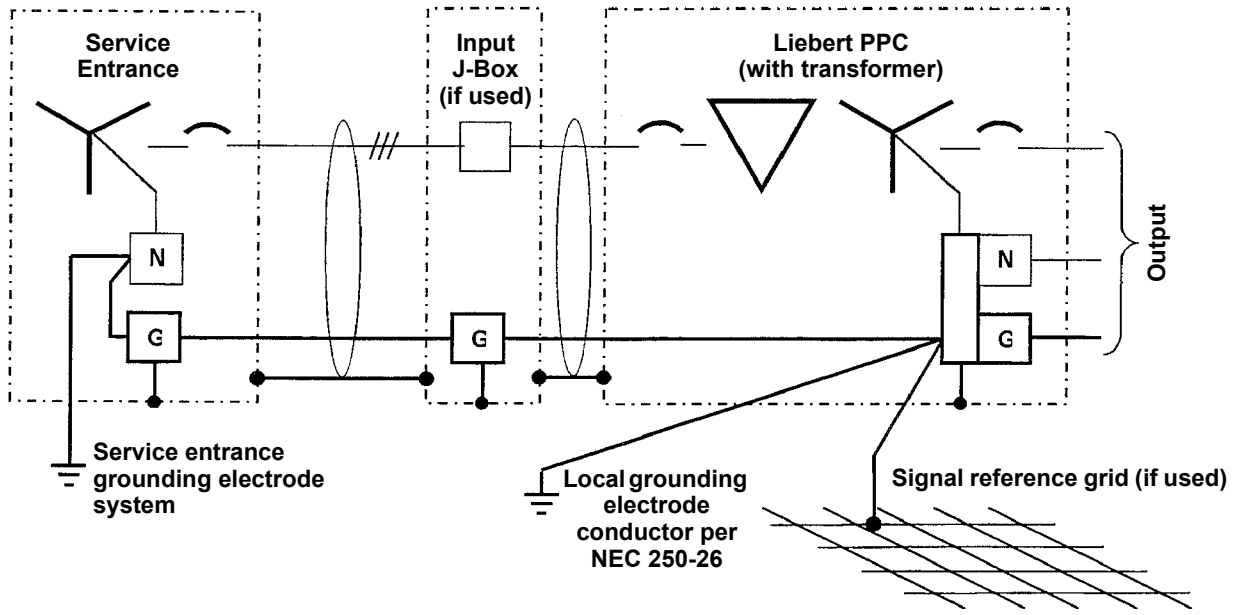
kVA	Output Voltage		
	208V	380V	415V
15	8	8	8
30	8	8	8
50	4	8	8
75	2	6	6
100	0	4	4
125	0	2	2
150	00	2	2
200	00	0	0
225	00	0	0

AWG wire size based on 75°C copper conductors

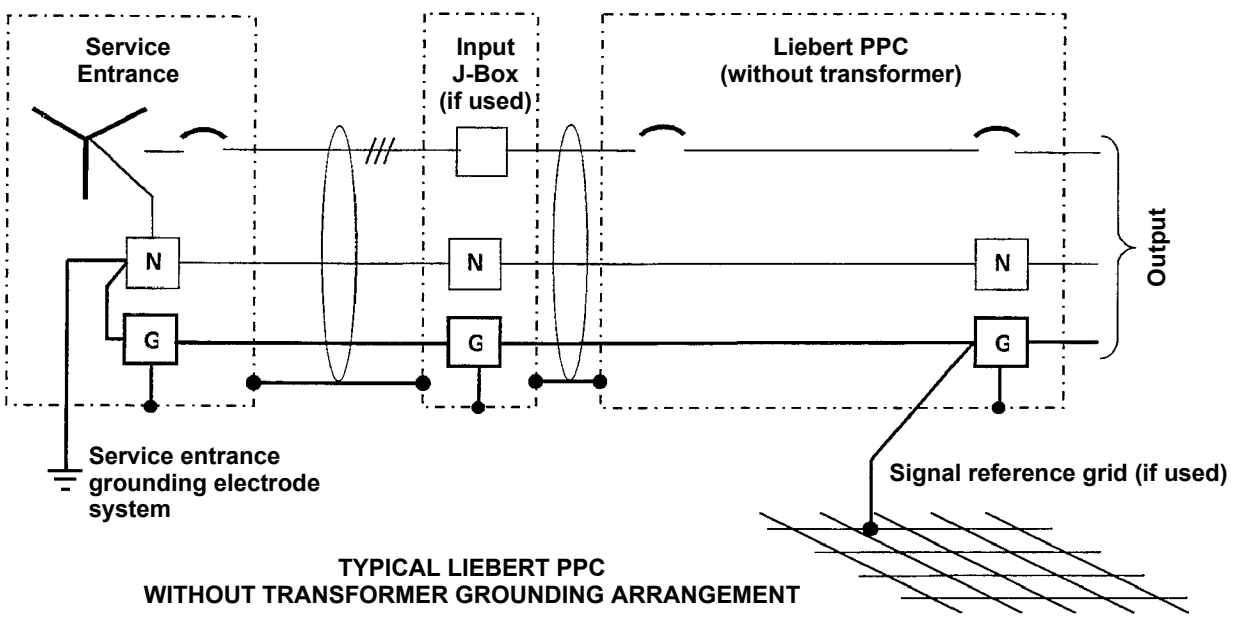
Recommended methods for running the grounding electrode conductor (arranged by preference for system performance; as acceptable by local and other applicable codes):

1. Outside of conduit (where not subject to damage)
2. Inside non-metallic conduit
3. Inside non-ferrous conduit
4. Inside ferrous conduit, bonded to the ferrous conduit at both ends, as acceptable by local and other applicable codes

Figure 14 Typical grounding arrangements



TYPICAL Liebert PPC WITH TRANSFORMER GROUNDING ARRANGEMENT



TYPICAL LIEBERT PPC WITHOUT TRANSFORMER GROUNDING ARRANGEMENT

1.3.5 Output Power Connections

Output circuit breaker(s) and/or panelboards with ground and neutral provisions are provided inside the unit for connecting load(s) as required. (See **Figures 6**, **8** and **10**.)

Flexible output distribution cables for use in data processing areas under a raised floor are optional and may be factory supplied. Cable lengths and layout should be well-planned:

- Cable access—Cable routes should follow aisles between equipment. This will facilitate access to cables for installation, routine inspection, and future changes.
- Cable length—Measure the distance to the load equipment following right-angle paths, rather than diagonally or directly. Always measure to the extreme far side of the equipment with respect to the unit to insure adequate cable length.
- Air circulation—Prevent restriction of airflow under the raised floor by running the flexible conduits flat on the sub-floor, in parallel paths.

For best performance, the Liebert PPC should be located as close to the load as practical.

Initial system output loading should be between 50% and 75% of rated capacity. This allows the addition of future loads without immediately investing in another power conditioner. The high partial-load efficiency of the unit permits such sizing without imposing an energy-use penalty during initial operation.

Keep the load balanced—Balancing of loads is good design practice on any 3-phase system. Accordingly, each distribution panel is load-balanced at the factory, based on output branch circuit breaker sizes. All additions to the system should be arranged so as to preserve this balance.

For phase-shifted, multi-output units, to ensure proper harmonic current cancellation, the loads should be balanced across the multiple outputs as well. For example, with a dual-output unit, the loads should be balanced across the six output phases. For a quad-output unit, the loads should be balanced across the 12 output phases.

WARNING

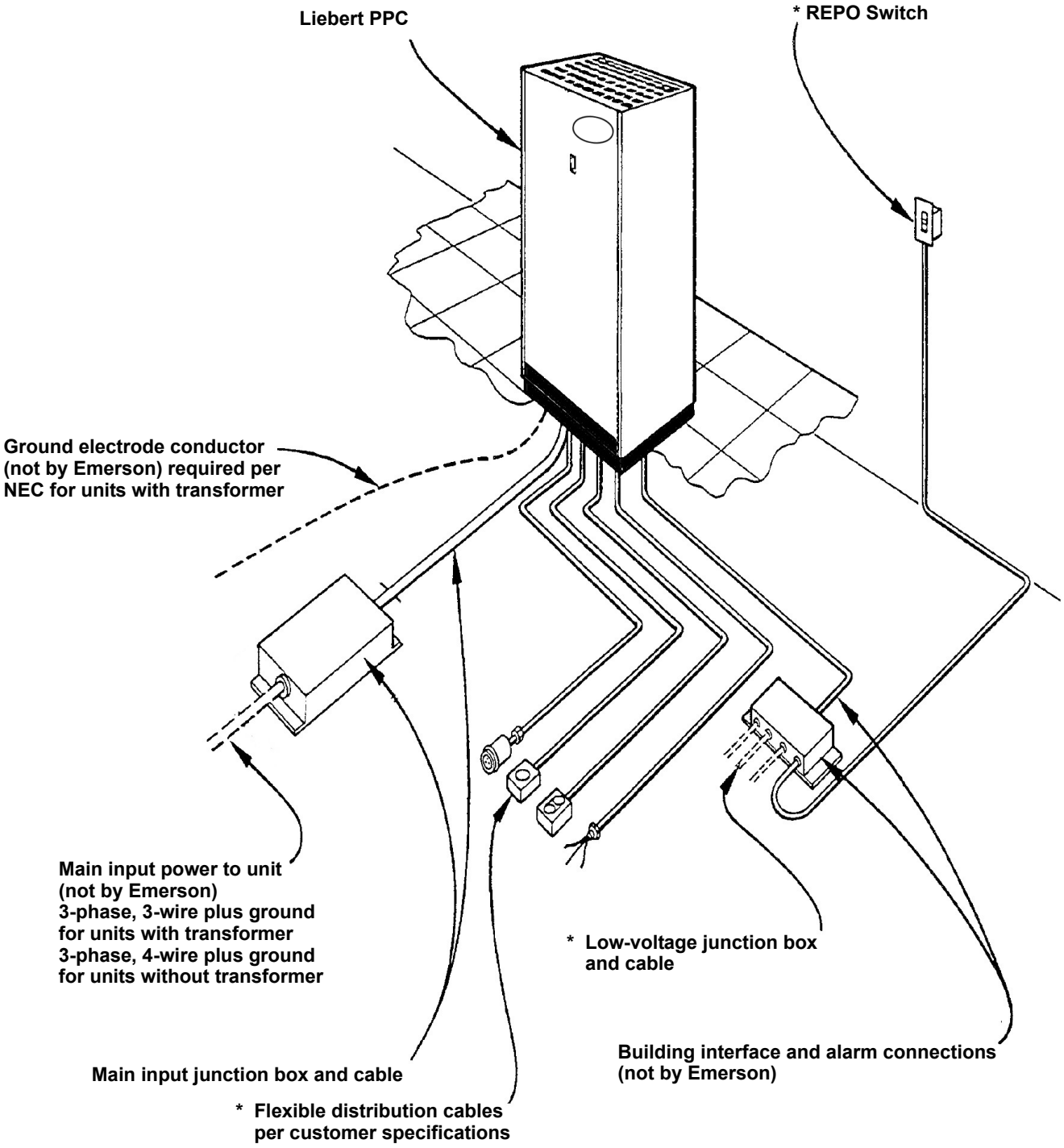
Risk of electric shock. Can cause injury or death.

Verify that incoming line voltage circuits are de-energized and locked out before installing output breakers and cables.

Code compliance—All output cables and connections must comply with the NEC and all other applicable codes.

Padlock-off provisions—All output cables without receptacles that are hard-wired to the load equipment must be equipped with a padlock-off accessory for the output circuit breaker. The padlock-off accessory is to be used to lock-out and tag the circuit breaker when service is performed on the hard-wired load equipment in accordance with OSHA safety rules.

Figure 15 Typical Liebert PPC equipment arrangement



* Optional devices—refer to the specification sheet for options supplied

1.3.6 Control Wiring Connections

The NEC Article 645 requires that emergency power off (EPO) switches be located at the principal room exits. All standard Liebert power conditioning systems have provision for external shutdown control from Remote Emergency Power Off (REPO) stations. **Figure 16** is a simplified diagram of the shutdown circuitry of the Liebert PPC.

Low-voltage control circuit—As shown in **Figure 16**, the control circuit operates on 24 VDC. The shutdown device (represented by the REPO switch) activates a low-current 24 VDC relay which in turn operates the shunt-trip mechanism. The shunt-trip solenoid opens the Main Input Breaker, which de-energizes the Liebert PPC.

Multiple-unit shutdown—When more than one Liebert PPC is installed by the user, a typical requirement is that actuation of a single device (REPO for example) must shut down all Liebert PPCs. The low-voltage control circuits of all standard Liebert PPC systems are designed to meet this requirement.

External control wiring connections for remote shutdown, alarm, and/or monitoring are made to the low-voltage junction box (if used) or to the low-voltage control terminal strip located inside the unit.

Control wiring connections vary with the type of monitoring system furnished with the unit. Two typical control wiring configurations are shown in **Figures 17** and **18**.

Code compliance—Control wiring connections must comply with the NEC and all other applicable codes.

WARNING

Risk of electric shock. Can cause injury or death.

Verify that all incoming high-voltage (power) and low-voltage (control) circuits are de-energized and locked out before installing cables or making connections, whether in the junction box or in the unit.

Figure 16 Simplified shutdown circuit

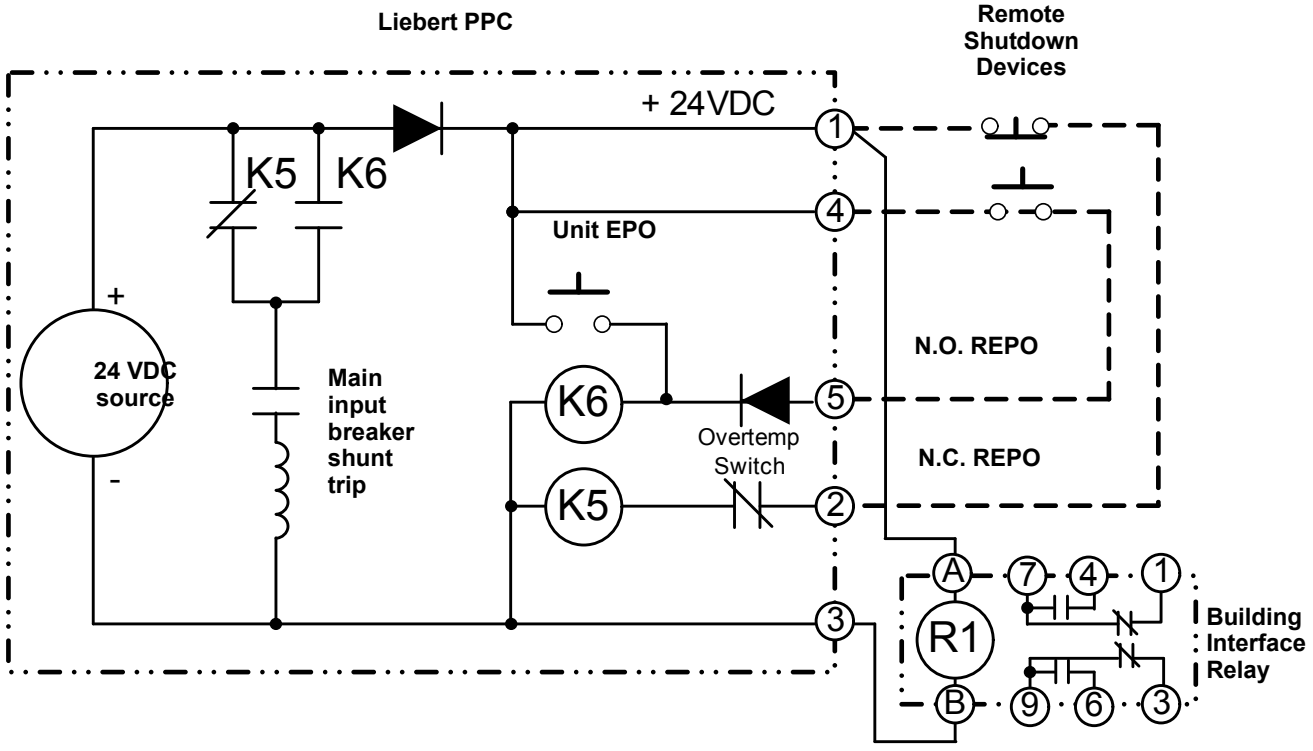
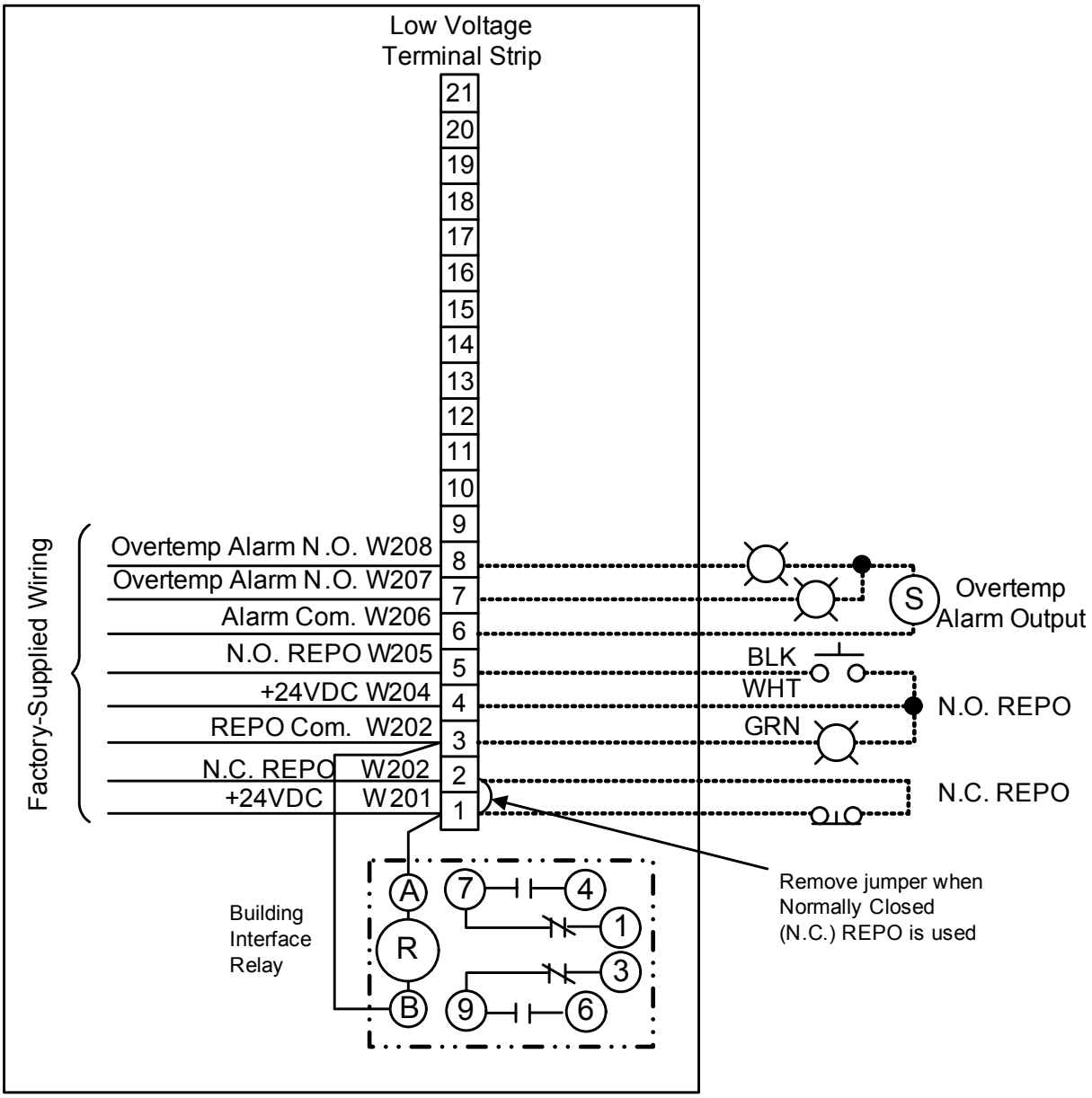


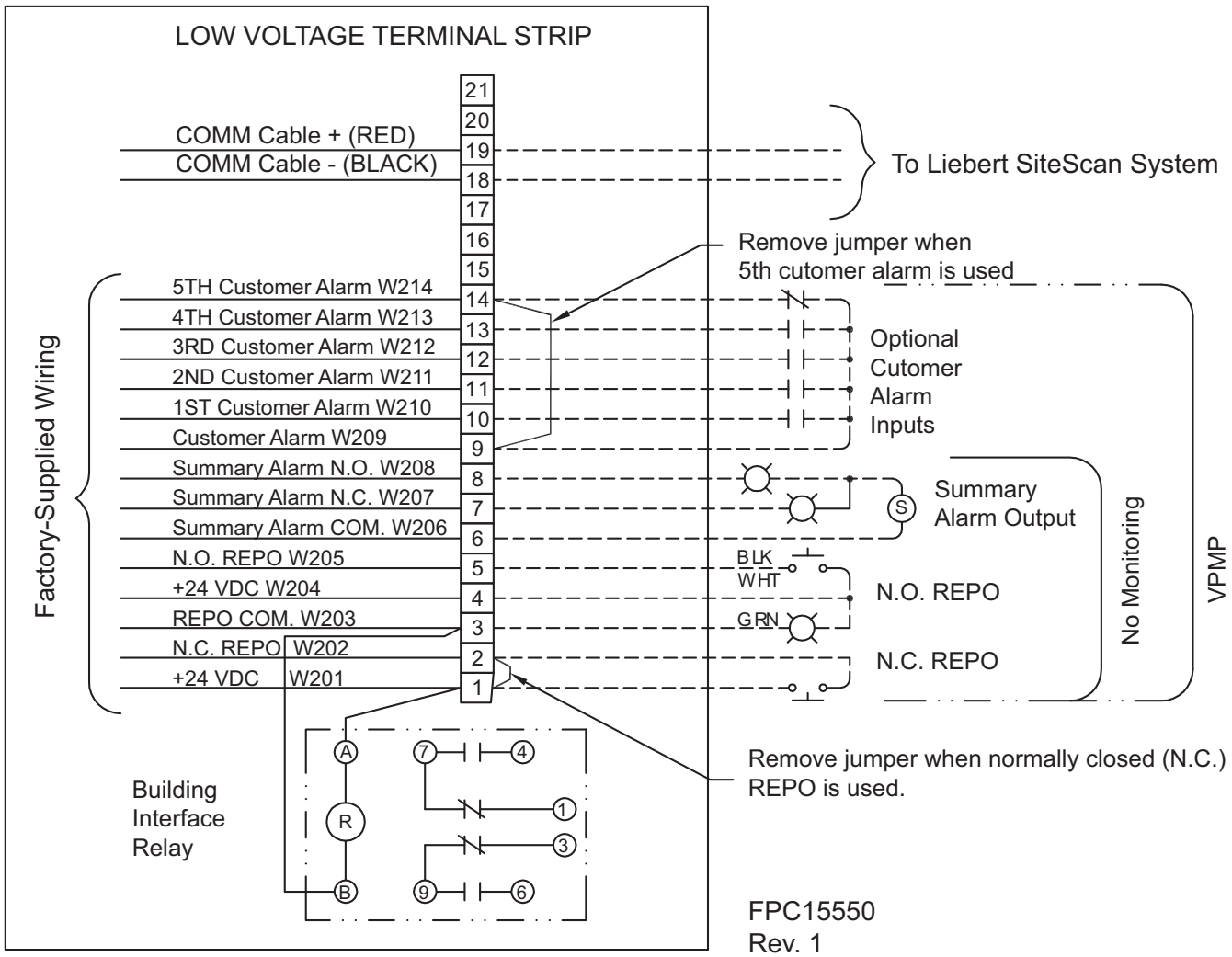
Figure 17 Typical control wiring for units without monitoring



NOTES

1. Building Interface Relay can be used for remote shutdown or alarm. Relay is energized during normal operation. DPDT contacts rated 1/4 HP at 120 VAC, 10A at 28VDC or 240VAC.
2. Other N.O. REPO devices may be wired in parallel to the N.O. REPO contacts. Other N.C. REPO devices may be wired in series to the N.C. REPO contacts. Multiple REPO lamps and other 24 VDC loads may be wired in parallel to the REPO lamps. Max. 24 VDC supply available is 1 Amp total. Both N.O. and N.C. REPO switches are powered from the same supply.
3. All auxiliary control devices and cabling to be field-supplied except as noted.
4. Overtemp Alarm contacts change state when unit overtemperature is sensed.

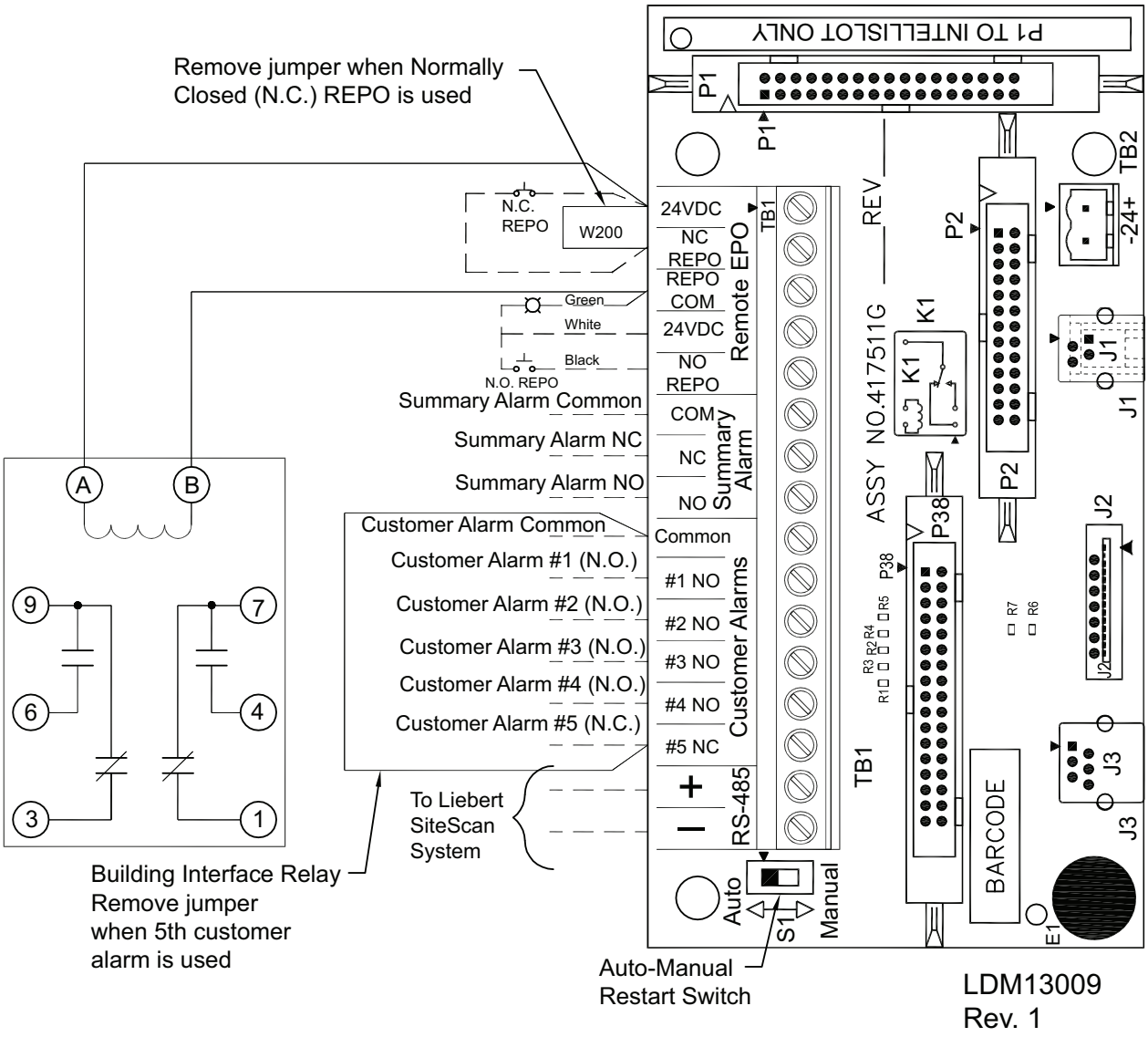
Figure 18 Typical control wiring for units with power monitoring



NOTES

1. All switching devices are to be suitable for switching low current 24VDC. Minimum recommended wire size is 18AWG stranded copper with 300V insulation.
   All wiring and devices are field-supplied except where noted. See installation manual for detailed installation procedures.
2. Low voltage terminal is located in low-voltage control junction box.
3. The total load on the 24VDC supply (both N.O. and N.C. REPO circuits) must be limited to 1A.
4. Multiple normally open (N.O.) REPO switches may be paralleled.
   Multiple normally closed (N.C.) REPO switches may be connected in series. All lamps (if used) are connected in parallel.
5. The summary alarm contacts are rated for 0 to 30VAC or VDC, 0.5A, 10W maximum.
6. Customer Alarms 1 through 4 are normally open (indicates alarm on contact closure). Customer Alarm 5 is normally closed (indicates alarm on contact opening).
7. For Liebert SiteScan connection, use #22AWG shielded cable; maximum distance 1000ft (300m).

Figure 19 Control wiring for units without low-voltage control box



NOTES

1. All switching devices are to be suitable for switching low current 24VDC. Minimum recommended wire size is 18AWG stranded copper with 300V insulation.
   All wiring and devices are field-supplied except where noted. See installation manual for detailed installation procedures.
2. The total load on the 24VDC supply (both N.O. and N.C. REPO circuits) must be limited to 1A.
3. Multiple normally open (N.O.) REPO switches may be paralleled.
   Multiple normally closed (N.C.) REPO switches may be connected in series. All lamps (if used) are connected in parallel.
4. The summary alarm contacts are rated for 0 to 30VAC or VDC, 0.5A, 10W maximum.
5. Customer Alarms 1 through 4 are normally open (indicates alarm on contact closure). Customer Alarm 5 is normally closed (indicates alarm on contact opening).
6. For Liebert SiteScan connection, use #22AWG shielded cable; maximum distance 1000ft (300m).

1.3.7 Adapter Board

The Adapter Board (AB) provides customer interface to the Liebert PPC monitoring systems for units without Low-Voltage Junction Box. Connections are made to terminal strip TB1 for Remote Emergency Power Off (REPO) switches, summary alarm contacts and customer alarms (Liebert Power Monitor Panel with Velocity protocol [VPMP]; see **4.3 Power Monitor Panel**). The AB is mounted on top of the monitoring enclosure located inside the top right corner of the unit.

A field-selectable switch (S1) on the AB allows the VPMP to be set up for either Manual or Auto restart. The factory default setting is **Manual**.

- **Manual Restart** allows for an orderly supervised startup after power failure. The control circuit automatically energizes the shunt trip mechanism of the main input breaker upon sensing output voltage failure.
- **Auto Restart** deactivates the manual restart function. In Auto Restart mode, the main input breaker does not trip due to power failure and the unit will restart when power is restored.

If two Liebert LDMF systems are provided, the summary alarm contacts from each Liebert LDMF are tied to the Customer Summary Alarm on the adapter board.

2.0 EQUIPMENT INSPECTION AND STARTUP

2.1 Internal Inspection

A detailed internal inspection should be performed after the unit is in place and before it is energized, to ensure trouble free startup. The same internal inspection should be carried out when performing preventive maintenance.

WARNING

Risk of electric shock. Can cause injury or death.

Verify that all incoming power and control circuits are de-energized and locked out before performing the internal inspection.

Open the unit—Remove the exterior panels to gain access to the Liebert PPC's internal components.

Visually Inspect—Be sure wiring and components are not damaged.

Check power connections—Check all power connections for tightness. Refer to **Tables 8** through **11** for torque requirements of all electrical connections.

Perform formal detailed inspection—Follow the procedures described in **3.0 Inspection and Startup Checklist** when performing detailed inspection.

2.2 Startup

Checklists—Follow the detailed step-by-step checklist (**3.0 Inspection and Startup Checklist**) when installing and starting up the Liebert PPC.

Initial system startup—A qualified electrician should be employed to perform the equipment inspection and startup. Liebert system startup may be arranged by calling your local Liebert sales representative or Emerson Network Power® Liebert Services. In the USA, call 1-800-LIEBERT.

Warranty effectivity—A copy of the appropriate checklist (furnished with the equipment) must be completed, signed, dated, and returned to Emerson. Warranty coverage of the equipment is not effective unless the Checklist is received by the factory**.**

WARNING

Risk of electric shock. Can cause injury or death.

Hazardous voltages are present during startup procedures. Equipment inspection and startup should be performed only by properly trained and qualified personnel.

Electrical safety precautions must be followed throughout inspection and startup.

Table 8 Torque specifications, general

	Electrical Connections with 1 Belleville Washer		Electrical Connections with 2 Belleville Washers	
	Torque		Torque	
	lb-in	N-m	lb-in	N-m
Bolt Shaft Size, in./mm				
1/4 / M6	40	4.5	80	9.0
5/16 / M8	80	9.0	160	18.0
3/8 / M10	120	13.6	240	27.1
1/2 / M12	240	27.1	480	54.2
Input and Output Breakers				
Up to 150A	80	9.0	160	18.0
175 - 500A	120	13.6	240	27.1

Table 9 Panelboard main circuit breaker torque specifications

	Torque	
	lb-in	N-m
Busbar-to-Breaker	240	27.1

Table 10 Branch circuit breaker torque specifications

Breaker Size	lb-in	N-m
Up to 30A	20	4.0
40 to 100A	20	5.1

Table 11 Terminal block compression lug torque specifications

AWG Wire Size or Range	Torque	
	lb-in	N-m
#14 - #10	35	4.0
#8	40	4.5

3.0 INSPECTION AND STARTUP CHECKLIST

Unit Serial Number _____

Unit Model Number _____

Date: _____

3.1 Inspection

WARNING

Risk of electric shock. Can cause injury or death.

All equipment inspection procedures are to be performed with power to the unit turned Off and locked out.

Exterior Inspection

___ 1. Confirm that the exterior of unit is undamaged (including cables and receptacles, if furnished).

___ 2. Confirm that service and ventilation clearances are adequate. (See **Figures 1** through **4**.)

Interior Inspection

___ 3. Remove accessible exterior panels.

NOTE

Disconnect the panel ground wires by separating the easy-disconnect terminals on the frame when removing exterior panels. Reconnect all panel ground wires when replacing the exterior panels.

___ 4. Inspect all wire and conductor insulation for damage.

___ 5. Check all transformer terminal connections for tightness. Retorque if necessary.

___ 6. Check all breaker connections for tightness. Retorque if necessary.

___ 7. Check all terminal block connections for tightness. Retorque if necessary.

___ 8. Check transformer mounting bolts for tightness. Retorque if necessary.

___ 9. Remove any foreign objects from the components or the interior area of the unit. Make sure air passages on transformers are clear and free of debris!

___ 10. Check that the intake and exhaust air screens are clean and free of obstructions.

___ 11. Replace side panels, leaving access to circuit breakers for the following startup procedure.

NOTE

Reconnect the panel ground wires before replacing the side panels.

3.2 Startup

WARNING

Risk of electric shock. Can cause injury or death.

Startup procedures should be performed only by properly trained and qualified personnel. Hazardous voltages are present in the equipment throughout the majority of the startup procedure. Use proper safety equipment. Proceed with caution.

1. Make certain that all circuit breakers are in the Off position and that power to the unit is locked out.

NOTE

*Steps **2** through **6** apply to the Main Input Junction Box. If this installation is not provided with a Main Input Junction Box, proceed to Step **7**.*

___ 2. Remove the cover of the Main Input Junction Box. Verify proper input power connections to unit, including equipment grounding conductor.

___ 3. Turn ON the building power to the junction box. Check the phase rotation at the junction box. Phase rotation should be A, B, C, as indicated.

___ 4. Check and record the input voltages at the junction box:

Volts, phase A to phase B =

Volts, phase B to phase C =

Volts, phase C to phase A =

___ 5. Turn Off and lock out the building power to the input junction box.

___ 6. Replace the junction box cover.

___ 7. Verify proper input power connections to unit, including equipment grounding conductor and local grounding electrode conductor.

___ 8. Turn On the building input power to the unit.

___ 9. Check phase rotation at main input breaker. Phase rotation should be A, B, C, left-to-right.

___ 10. Check and record the input voltage at the main input breaker. Measured voltages should correspond to the unit's nameplate input voltage.

Volts, phase A to phase B =

Volts, phase B to phase C =

Volts, phase C to phase A =

___ 11. Turn ON the main input breaker; wait one minute. (If breaker trips Off, check for wiring errors including control connections. Contact Liebert Services or the location factory representative for assistance.)

___ 12. Check the phase rotation at the line side terminals (top) of the panelboard main breaker(s) and any subfeed output circuit breaker(s). The rotation should be A, B, C, left-to-right.

___ 13. Check and record the voltages at the line-side terminals of the output circuit breaker. Measured voltages should correspond to the unit's nameplate output voltage (within +4%,-0%).

Volts, phase A to phase B =

Volts, phase B to phase C =

Volts, phase C to phase A =

Volts, phase A to neutral =

Volts, phase B to neutral =

Volts, phase C to neutral =

If output voltage is incorrect, check for wiring errors, incorrect input voltage, or improper transformer tap. Contact Liebert Services at 1-800-LIEBERT in the USA or the local factory representative for assistance.

NOTE

The Liebert PPC transformer has input voltage taps for each input phase. The taps are arranged in 2-1/2% or 5% intervals ranging from -10% to nominal to +5%. This permits the transformer to provide the proper output voltage for a range of input voltages. Should it be necessary, the tap arrangement may be changed to match the input voltage:

- *Open main input circuit breaker.*
- *Select tap arrangement to match input voltage. (Refer to transformer nameplate for tap information.)*
- *Secure each line to its proper tap.*
- *Repeat Steps **11** to **13**.*

___ 14. Depress the local Emergency Power Off switch and verify system shutdown. Turn the unit back On.

___ 15. Repeat Step **14** for each REPO switch with which the system is equipped.

NOTICE

Risk of shutting down systems inadvertently. Can cause equipment damage.

Using the REPO switch may shut down more equipment or systems than just the Liebert PPC. Ascertain whether necessary systems might be shut down before performing the procedure.

3.3 Monitoring System Check-Out

___ 16. **BASIC INDICATORS**

a. Turn On the building power to the unit, then turn the Main Input Breaker On.

b. Check that the Power LED on the front panel is illuminated.

___ 17. **MANUAL RESTART CHECK. If unit is equipped with Manual Restart**

a. Turn on building power to the unit. Turn Main Input breaker On.

b. Turn Off all building power to unit.

c. Observe that Main Input Breaker automatically trips open upon power loss.

d. Restore building power to the unit and return Main Input breaker to On.

___ 18. **POWER MONITOR PANEL. If unit is equipped with a Power Monitor Panel:**

Turn the unit On. Ensure that the voltage values indicated by the Monitor Panel correspond to the voltage values measured at the input and output circuit breaker (Steps **10** and **13**).

___ 19. **CENTRALIZED MONITOR. If the unit is connected to a Centralized Monitoring System:**

Turn the unit and Centralized Monitoring System On. Verify proper communication to the monitor system operation.

___ 20. **CONTROL VOLTAGE:**

a. Obtain access to the low voltage terminals in the Low-Voltage Junction Box (if used), or in the low voltage control section inside unit.

b. With the unit On, measure and record the DC control voltage on Terminals 1 (+) and 3 (com).

c. **Control Voltage =**

(Voltage should be between 20 and 28VDC).

___ 21. **CUSTOMER ALARMS. If customer alarms are provided:**

a. With the unit On, simulate alarm operation by jumpering the appropriate low voltage control terminals. (Refer to the control wiring installation drawing furnished with the unit.)

b. Verify correct alarm annunciation by the Power Monitor Panel and/or by the Centralized Monitoring System.

3.4 Equipment Connection Check-Out (For Units With Distribution Cables)

WARNING

Risk of electric shock. Can cause injury or death.

All loads should be disconnected or turned off before proceeding with the following steps.

For units with output distribution cables, be sure that there are no output receptacles connected to load equipment plugs and that the receptacles are not in contact with foreign objects.

Pay special attention to those output cables intended for direct wiring connection; the exposed conductor ends of these cables must not be in contact with each other or with any foreign objects.

___ 22. Turn On main input power to the unit, then turn On the panelboard main output breaker(s).

___ 23. Individually turn On each branch circuit breaker and check the output voltage (also phase rotation, if a 3-phase circuit) at the receptacle or cable end.

___ 24. Turn Off all branch circuit breakers and the panelboard main output circuit breaker(s).

___ 25. Connect the load equipment per equipment manufacturer's specifications and recommendations.

___ 26. Turn On the panelboard main output breaker(s).

___ 27. Turn On branch circuit breakers to the load equipment.

Observe the power-up sequence recommended by the equipment manufacturer.

___ 28. Verify that all load equipment operates properly.

___ 29. Replace all unit panels.

After performing the inspection and startup procedure described in **3.0 Inspection and Startup Checklist** in this manual, complete the Startup and Inspection form furnished with the unit, sign the completed form and return it to:

Liebert Corporation
1050 Dearborn Drive
P.O. Box 29186
Columbus, Ohio 43229 USA

NOTE

Warranty is not in effect unless Inspection and Startup form is received by the factory.

4.0 OPERATING INSTRUCTIONS

4.1 Startup Procedures

Before the unit is placed into service after initial installation, after equipment relocation, or after equipment has been de-energized for an extended period of time, perform equipment inspection and startup procedures as detailed in the previous two sections, **2.0 Equipment Inspection and Startup** and **3.0 Inspection and Startup Checklist**.

After initial system startup, the following guidelines can be used for standard equipment operation. These guidelines should be reviewed for any special equipment modifications, special site considerations, or company policies which may require changes to the standard equipment operation.

4.1.1 Emergency Shutdown

To perform an immediate system shutdown during emergency conditions, lift the protective clear cover and push the "Emergency Power Off" (EPO) switch located on the unit front door.

NOTE
Depending on the particular control circuit wiring, operation of the unit EPO switch may cause other equipment to also shutdown.

If the site is equipped with a REPO switch (as required by NEC Article 645 at the principal exit doors), to perform an immediate room shutdown, activate one of the REPO switches.

4.1.2 Normal System Shutdown

To perform a normal system shutdown, perform an orderly load equipment (computer system) shutdown according to the load equipment manufacturer's recommended shutdown sequence. The load equipment can be turned Off at each piece of load equipment or at the Liebert PPC's output distribution (circuit breaker) panels located behind the unit's front door. Turn OFF all unit output breakers, then turn Off the unit's main input circuit breaker. To remove all power from the unit, turn OFF the building power to the unit's input breaker or junction box.

4.1.3 Normal System Turn ON

Make certain all unit circuit breakers are in the Off position. All unit circuit breakers are located behind the front doors. Turn ON building power to the unit. Turn On the unit's main input circuit breaker. If the circuit breaker has been tripped Off (instead of being turned Off), the circuit breaker handle must be moved to the Off position before being turned On. If the unit has a voltage monitoring panel, verify proper output voltages before turning On output circuit breakers. Turn On the panelboard main breakers. Individually turn On each output circuit breaker following the load equipment manufacturer's startup sequence.

4.1.4 Manual Restart

If unit's manual restart feature has been selected, the unit's main input circuit breaker will be tripped upon a power outage, preventing repetitive application of unstable voltage and allowing for an orderly system restart. If the main input circuit; breaker is tripped upon a power outage, after power is restored, follow the instructions outlined in **4.1.3 Normal System Turn ON**.

4.2 Basic Monitor Panel

Basic Monitoring provides transformer overtemperature alarm, transformer overtemperature shutdown and Emergency Power Off controls only.

4.2.1 Display Controls and Indicators

- **Power Indicator (Green LED)**—illuminates when power has been applied to the Liebert AC Power product.
- **Alarm Status Indicator (Red LED)**—illuminates when an alarm is present. The LED will remain illuminated until the alarm condition is cleared.
- **Audible Alarm speaker** (represented by the speaker symbol)—a speaker behind the bezel will sound when there is an alarm condition.
- **Silence/Reset Push Button**—Press and release the Silence/Reset button to silence the audible alarm. Press and hold the button to clear the alarm and turn Off the red alarm indicator LED. If the alarm condition still exists the alarm will be annunciated again.
- **Emergency Power Off (EPO) Push Button**—pressing the EPO button shunt trips the input circuit breaker to turn the unit off.
- **LCD**—Note used.
- **Navigation keys** (soft function keys F1 through F4 and Help)—Not used.

If an overtemperature condition occurs—when the transformer temperature exceeds 356°F (180°C)—it should be investigated and corrected. Possible causes include transformer overload, excessive non-linear loading, inadequate ventilation, high or low input voltage and monitoring malfunction.

Failure to correct the overtemperature condition may result in an automatic system shutdown due to the second stage of overtemperature sensing, when the transformer temperature exceeds 392°F (200°C). After the alarm condition is corrected, the alarm will automatically reset.

See **Figure 17** for remote summary alarm and Remote Emergency Power Off switch connections.

Figure 20 Liebert PPC controls and indicators

4.3 Power Monitor Panel

Liebert Power Monitor Panel with Velocity protocol (VPMP) provides input voltage, output current and voltage and other power parameters and will detect and annunciate alarm messages. The monitored parameters and alarms will be displayed on the local display and be available for communication to a customer or Liebert monitoring system.

The VPMP includes a monochrome Liquid Crystal Display (LCD), power and alarm LEDs, an audible alarm and alarm silence and Emergency Power Off push buttons mounted on the front door.

Display Controls and Indicators

- **Power Indicator (Green LED)**—illuminates when power has been applied to the Liebert AC Power product.
- **Alarm Status Indicator (Red LED)**—illuminates when the VPMP detects an alarm. The LED will remain illuminated until the alarm condition is cleared.
- **Audible Alarm speaker** (represented by the speaker symbol)—a speaker behind the bezel will sound when the Liebert VPMP records an alarm condition.
- **Silence/Reset Push Button**—Press and release the Silence/Reset button to silence the audible alarm. Press and hold the button to clear the alarm and turn Off the red alarm indicator LED. If the alarm condition still exists the alarm will be annunciated again.
- **Emergency Power Off (EPO) Push Button**—pressing the EPO button shunt trips the input circuit breaker to turn the unit off.
- **LCD**—displays power parameters and alarm data.
- **Navigation keys** (soft function keys F1 through F4 and Help):
  - **F1** selects the next Main Breaker or Next Subfeed.
  - **F2** is the Sequence key. It selects the next set of items at the current level or the next item on a list.
  - **F3** can select Subfeed (if supplied and monitored) at the top level or can select a menu item at a lower level.
  - **F4** can select Branch a Back function at lower levels.

    Pressing the Back key (F4) navigates to the top level (Main) except from the Help screen.

    From the Help screen, the Back key navigates to the previous screen.
  - Pressing the **Help** key navigates to the Help screen.

All alarm thresholds for monitored parameters are adjustable by way of the VPMP DB-9 setup port to match site requirements. All alarms are stored in non-volatile memory to protect against erasure by a power outage. Alarms must be reset manually after the alarm condition has been corrected. Alarms may be reset by pushing the Silence/Reset button on the display or through the remote monitoring system (if used).

The following metering parameters may be displayed:

- Input Voltage, Line-to-Line for all three phases
- Output Voltages, Line-to-Line for all three phases
- Output Voltages, Line-to-Neutral for all three phases
- Output Voltage Total Harmonic Distortion (THD) for all three phases
- Output Current for all three phases
- Output Current Total Harmonic Distortion (THD) for all three phases
- Output Current Crest Factor (Peak/RMS) for all three phases
- Output Current Harmonic K-Factor for all three phases
- Output Neutral Current
- System Ground Current
- Output Frequency
- Output kVA
- Output kW
- Output Power Factor
- Output kW-Hours
- Percent Load
- Date
- Time

The VPMP detects and annunciates by alarm message the following conditions:

- Output Overvoltage
- Output Undervoltage
- Output Overcurrent
- Neutral Overcurrent
- Ground Overcurrent
- Output Voltage Distortion
- Frequency Deviation
- Phase Sequence Error
- Phase Loss
- Transformer Overtemperature

All alarm thresholds for monitored parameters are adjustable by way of the VPMP DB-9 setup port to match site requirements. The factory setpoints for the alarms are as follows:

- **Output Overvoltage**— voltage exceeds +6% of nominal
- **Output Undervoltage**— voltage falls below - 13% of nominal
- **Output Overcurrent**— current exceeds 95% of full load amps
- **Neutral Overcurrent**— current exceeds 95% of full load amps
- **Ground Overcurrent**— current exceeds: 5 amps (15-125kVA); 10 amps (150-225kVA)
- **Output Voltage Distortion**—output voltage THD exceeds 10%
- **Frequency Deviation**—output frequency exceeds ±0.5Hz of nominal

Summary Alarm

- **Summary Alarm**—detects and annunciates any alarm.

Summary Alarm Contacts

- The VPMP has a Form C (one NO and one NC) summary alarm contact for remote alarm status. The contacts are rated at 24VAC @ 1A. The contacts change state upon occurrence of any alarm including warnings and resets when the alarm is cleared. Summary alarm contacts are located on the adapter board. The adapter board is located on top of the monitoring enclosure. See **Figure 19** for details.

Communication—Liebert IntelliSlot® cards provide customer connections to a Building Management System (BMS) or Remote Monitoring Systems. The following cards are available:

- **IS-WEBS Card**—provides SNMP/WEB output. An RJ-45 connector is supplied for customer connection to Ethernet LAN.
- **IS-485S Card**—provides Modbus 485 output. A terminal strip is provided for 2-wire connection.
- **IS-IPBMS Card**—provides Modbus IP output. An RJ-45 connector is supplied for customer connection

Up to three cards can be plugged into the Liebert IntelliSlot ports provided with the VPMP system.

If communication to Liebert SiteScan® is required, customer connection can be made to the adapter board RS-485 terminals on TB1, see **Figure 19** for details. The adapter board is located on top of the monitoring enclosure.

4.4 Liebert Current Plus Monitoring (If Supplied)

Liebert Current Plus Monitoring (Liebert CPM) provides the current and voltage of each panelboard main circuit breaker. These measurements are used for reporting the average RMS current, power and other parameters. The Liebert CPM detects and annunciates alarm messages and status conditions for each panelboard main circuit breaker. The monitored parameters and alarms appear on the local display and are available for communication to a customer or Liebert monitoring system.

The Liebert CPM includes a monochrome LCD, power and alarm LEDs, an audible alarm and alarm silence and Emergency Power Off push buttons mounted on the front door.

Display Controls and Indicators

- **Power Indicator (Green LED)**—illuminates when power has been applied to the Liebert AC Power product.
- **Alarm Status Indicator (Red LED)**—illuminates when the Liebert CPM detects an alarm. The LED will remain illuminated until the alarm condition is cleared.
- **Audible Alarm speaker** (represented by the speaker symbol)—a speaker behind the bezel will sound when the Liebert CPM records an alarm condition.
- **Silence/Reset Push Button**—Press and release the Silence/Reset button to silence the audible alarm. Press and hold the button to clear the alarm and turn Off the red alarm indicator LED. If the alarm condition still exists the alarm will be annunciated again.
- **Emergency Power Off (EPO) Push Button**—pressing the EPO button shunt trips the input circuit breaker to turn the unit off.
- **LCD**—displays power parameters and alarm data.
- **Navigation keys** (soft function keys F1 through F4 and Help):
  - **F1** selects the next Main Breaker.
  - **F2** is the Sequence key. It selects the next set of items at the current level or the next item on a list.
  - **F3** can select a menu item.
  - **F4** can provide a Back function at lower levels.
    Pressing the Back key (F4) navigates to the top level (Main) except from the Help screen.
    From the Help screen, the Back key navigates to the previous screen.
  - Pressing the **Help** key navigates to the Help screen.

All alarm thresholds for monitored parameters are adjustable by way of the DB-9 setup port to match site requirements. All alarms are stored in non-volatile memory to protect against erasure by a power outage. Alarms must be reset manually after the alarm condition has been corrected. Alarms may be reset by pushing the Silence/Reset button on the display or through the remote monitoring system (if used).

The Liebert CPM monitors and displays the following parameters for the panelboard main circuit breaker:

- Phase Current
- Percent Load
- kW
- kW-Hours

The following metering parameters may be displayed:

- Voltage—Line-to-Line
- Voltage—Line-to-Neutral
- Neutral Current
- Ground Current
- kVA
- Power Factor
- Voltage Total Harmonic Distortion (THD)
- Current Total Harmonic Distortion (THD)
- Crest Factor

Circuit identification and status of each breaker may be displayed.

The Liebert CPM detects and annunciates by alarm message the following conditions:

- Overvoltage
- Undervoltage
- Neutral Overcurrent
- Ground Overcurrent
- Phase Overcurrent
- Phase Overcurrent Warning
- Summary Alarm

All alarm thresholds for monitored parameters are adjustable by way of the DB-9 setup port to match site requirements. The factory setpoints for the alarms are as follows:

- **Overvoltage**—at least one of the line-to-line voltages exceeds +6% of nominal
- **Undervoltage**—at least one of the line-to-line or line-to-neutral voltages falls below -13% of nominal
- **Phase Overcurrent Warning**—current exceeds 75% of breaker amps
- **Phase Overcurrent**—current exceeds 80% of breaker amps
- **Neutral Current**—current exceeds 95% of breaker amps
- **Ground Current**—current exceeds 5A (15-125kVA); 10A (150-225kVA)

Summary Alarm

- **Summary Alarm**—detects and annunciates any alarm.

Summary Alarm Contacts

- The LDMF has a Form C (one NO and one NC) summary alarm contact for remote alarm status. The contacts are rated at 24VAC @ 1A. The contacts change state upon occurrence of any alarm including warnings and reset when the alarm is cleared. Summary alarm contacts are located on the adapter board. The adapter board is located on top of the monitoring enclosure. See **Figure 19** for details.

Communication—Liebert IntelliSlot® cards provide customer connections to a Building Management System (BMS) or Remote Monitoring Systems. The following cards are available:

- IS-WEBS Card—provides SNMP/WEB output. An RJ-45 connector is supplied for customer connection to Ethernet LAN.
- IS-485S Card—provides Modbus 485 output. A terminal strip is provided for two-wire connection.
- IS-IPBMS Card—provides Modbus IP output. An RJ-45 connector is supplied for customer connection.

Up to three cards can be installed in the Liebert IntelliSlot ports provided with the Liebert CPM system.

If communication to Liebert SiteScan® is required, customer connection can be made to the adapter board RS-485 terminals on TB1, see **Figure 19** for details. The adapter board is located on top of the monitoring enclosure.

4.5 Liebert Distribution Monitoring (If Supplied)

The Liebert Distribution Monitoring (Liebert LDMF) provides the current and voltage for each branch circuit breaker mounted on the panelboards and the panelboard main circuit breaker. These measurements are used for reporting the average RMS current, power and other parameters. The Liebert LDMF detects and annunciates alarm messages and status conditions for each branch circuit breaker and the panelboard main circuit breaker. The monitored parameters and alarms appear on the local display (if supplied) and are available for communication to a customer or Liebert monitoring system.

The Liebert LDMF (if supplied) includes a monochrome LCD, power and alarm LEDs, an audible alarm and alarm silence and Emergency Power Off push buttons mounted on the front door.

Display Controls and Indicators

- **Power Indicator (Green LED)**—illuminates when power has been applied to the Liebert AC Power product.
- **Alarm Status Indicator (Red LED)**—illuminates when the Liebert LDMF detects an alarm. The LED will remain illuminated until the alarm condition is cleared.
- **Audible Alarm speaker** (represented by the speaker symbol)—a speaker behind the bezel will sound when the Liebert LDMF records an alarm condition.
- **Silence/Reset Push Button**—Press and release the Silence/Reset button to silence the audible alarm. Press and hold the button to clear the alarm and turn Off the red alarm indicator LED. If the alarm condition still exists the alarm will be annunciated again.
- **Emergency Power Off (EPO) Push Button**—pressing the EPO button shunt trips the input circuit breaker to turn the unit off.
- **LCD**—displays power parameters and alarm data.
- **Navigation keys** (soft function keys F1 through F4 and Help):
  - **F1** selects the next Main Breaker, Next Subfeed or Next Branch.
  - **F2** is the Sequence key. It selects the next set of items at the current level or the next item on a list.
  - **F3** can select Subfeed (if supplied and monitored) at the top level or a menu item at a lower level.
  - **F4** can select Branch Breakers at the top level or provide a Back function at lower levels. Pressing the Back key (F4) navigates to the top level (Main) except from the Help screen. From the Help screen, the Back key navigates to the previous screen.
  - Pressing the **Help** key navigates to the Help screen.

All alarm thresholds for monitored parameters are adjustable by way of the LDMF DB-9 setup port to match site requirements. All alarms are stored in non-volatile memory to protect against erasure by a power outage. Alarms must be reset manually after the alarm condition has been corrected. Alarms may be reset by pushing the Silence/Reset button on the display or through the remote monitoring system (if used).

The Liebert LDMF monitors and displays the following parameters for the panelboard main circuit breaker, each branch circuit breaker and subfeed circuit breakers (if supplied and monitored):

- Phase Current
- Percent Load
- kW
- kW-Hours

The following metering parameters may be displayed:

- Voltage—Line-to-Line
- Voltage—Line-to-Neutral
- Neutral Current
- Ground Current
- kVA
- Power Factor
- Voltage Total Harmonic Distortion (THD)
- Current Total Harmonic Distortion (THD)
- Crest Factor

Circuit identification and status of each breaker may be displayed.

The Liebert LDMF detects and annunciates by alarm message the following conditions:

- Overvoltage
- Undervoltage
- Neutral Overcurrent
- Ground Overcurrent
- Phase Overcurrent
- Phase Overcurrent Warning
- Summary Alarm

All alarm thresholds for monitored parameters are adjustable by way of the LDMF DB-9 setup port to match site requirements. The factory setpoints for the alarms are as follows:

- **Overvoltage**—at least one of the line-to-line voltages exceeds +6% of nominal
- **Undervoltage**—at least one of the line-to-line or line-to-neutral voltages falls below -13% of nominal
- **Phase Overcurrent Warning**—current exceeds 75% of breaker amps
- **Phase Overcurrent**—current exceeds 80% of breaker amps
- **Neutral Current**—current exceeds 95% of breaker amps
- **Ground Current**—current exceeds 5A (15-125kVA); 10A (150-225kVA)

Summary Alarm

- **Summary Alarm**—detects and annunciates any alarm.

Summary Alarm Contacts

- The CPM has a Form C (one NO and one NC) summary alarm contact for remote alarm status. The contacts are rated at 24VAC @ 1A. The contacts change state upon occurrence of any alarm including warnings and resets when the alarm is cleared. Summary alarm contacts are located on the adapter board. The adapter board is located on top of the monitoring enclosure. See **Figure 19** for details.

Communication—Liebert IntelliSlot® cards provide customer connections to a Building Management System (BMS) or Remote Monitoring Systems. The following cards are available:

- **IS-WEBS Card**—provides SNMP/WEB output. An RJ-45 connector is supplied for customer connection to Ethernet LAN.
- **IS-485S Card**—provides Modbus 485 output. A terminal strip is provided for 2-wire connection.
- **IS-IPBMS Card**—provides Modbus IP output. An RJ-45 connector is supplied for customer connection.

Up to three cards can be plugged into the IntelliSlot ports provided with the Liebert LDMF system.

If communication to Liebert SiteScan® is required, customer connection can be made to the adapter board RS-485 terminals on TB1, see **Figure 19** for details. The adapter board is located on top of the monitoring enclosure.

5.0 MAINTENANCE

5.1 Corrective Maintenance

Even the most reliable equipment may fail. Emerson® Network Power Liebert Services is at your service to assure fast repair of your unit and minimum down-time of your installation.

WARNING

Risk of electric shock. Can cause injury or death.

Hazardous voltages are present within the Liebert PPC. Only properly trained and qualified service personnel should perform maintenance on the Liebert PPC system. All voltage sources to the unit must be disconnected before inspecting or cleaning within the cabinet.

Standard electrical troubleshooting procedures should be used to isolate problems in the unit. If there are questions, don't hesitate to contact Liebert Services.

Repair or replacement of standard items, such as circuit breakers, fuses, transformers, capacitors, and indicator lights can be either handled by qualified electricians or referred to Liebert Services.

Repairs related to the monitoring system should be referred to Liebert Services.

To contact Liebert Services for information or repair service in the USA, call 1-800-LIEBERT.

5.2 Preventive Maintenance (Inspection and Cleaning)

Air circulation through the cabinet may cause dust to accumulate on internal components. Cleaning should be done as necessary during electrical inspections.

Annual general system inspections, cleaning, and operation checks are recommended to ensure system performance and long service life.

WARNING

Risk of electric shock. Can cause injury or death.

Hazardous voltages are present within the Liebert PPC. Only properly trained and qualified service personnel should perform maintenance on the Liebert PPC system. All voltage sources to the unit must be disconnected before inspecting or cleaning within the cabinet.

Inspection Schedule

- It is difficult to establish a schedule for periodic cleanings since conditions vary from site to site. Inspections after the first 24 hours, 30 days and 6 months of operation should help determine a pattern for the inspection schedule.
- Electrical connections and component mountings should be inspected after the first 24 hours, 30 days, and 6 months of operation. Inspections should be conducted annually thereafter.
- Ventilation openings and grilles should be inspected and cleaned every six months to one year.
- A complete inspection and operational checkout should be performed annually. This is best done by performing the inspection and startup procedure as detailed in **3.0 Inspection and Startup Checklist**.
- Liebert Services offers a complete range of preventive maintenance services. These include thorough equipment performance checks, and calibration of electronics. Contact Liebert Services in the USA (1-800-LIEBERT) for details.

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